Division of Agricultural Sciences
UNIVERSITY OF CALIFORNIA

# SACRAMENTO VALLEY RICE FARMS

## 1. Organization, Costs, and Returns

Gordon R. Sitton



CALIFORNIA AGRICULTURAL EXPERIMENT STATION
GIANNINI FOUNDATION OF AGRICULTURAL ECONOMICS

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## ACKNOWLEDGMENTS

This report of rice production on farms in the Sacramento Valley resulted from a study by the Giannini Foundation of Agricultural Economics, California Agricultural Experiment Station and the Farm Economics Research Division, Agricultural Research Service, United States Department of Agriculture.

Trimble R. Hedges, Professor of Agricultural Economics, Agricultural Economist in the Experiment Station and on the Giannini Foundation, and Warren R. Bailey, Assistant Head, Western Field Research Section of the Farm Economics Research Division, participated in outlining and developing the project outline and plans.

Professor Hedges and George W. Campbell, formerly Research Assistant in the Department of Agricultural Economics assisted in collecting field data from rice growers.

We are indebted to farmers and representatives of many business firms who gave informations and data for this investigation. We particularly thank the California Agricultural Stablization and Conservation Committee for providing data from their files necessary for establishing lists of rice growers from which a sample could be selected, and the California Agricultural Extension Service for aid in this survey.

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# SACRAMENTO VALLEY RICE FARMS

## No. 1. Organization, Costs, and Returns [1]

Gordon R. Sitton [2]

### PHYSICAL REQUIREMENTS OF RICE PRODUCTION DIFFER FROM THOSE FOR OTHER CROPS

Cultural practices used in rice production are similar in many respects to those for other small grains. They differ in that rice must be grown under unique conditions of irrigation. "Irrigation" for all other crops means to moisten the soil. Rice is not grown in moist soil but in a flooded pond where water stands several inches above the ground for three to five months.

The irrigation requirements of rice mean that this crop has different soil and water requirements from the other grains.

Economical rice production requires:

1. Soils that are relatively impervious so that the amount of water lost by percolation will be minimized.
2. Large amounts of low cost water.
3. Drainage conditions that will permit drying the fields sufficiently to allow the preparation of a seedbed and satisfactory harvest conditions.

Rice may be economically grown on soils that will not satisfactorily produce other crops because:

1. Good winter drainage is not required.
2. Good drainage during the growing season is not required.
3. The fine texture of clay soil is a benefit rather than a detriment.

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1/ This report is the first in a series based on detailed investigations of the organization and operations of rice farms in the Sacramento Valley during the period 1950-1954, and supplemented by more recent data. This research comes under California Agricultural Experiment Station Project No. 1258 and is partially supported by the Farm Economics Research Division, U.S.D.A.

2/ Gordon R. Sitton was formerly Assistant Professor of Agricultural Economics, Assistant Agricultural Economist in the Experiment Station and Assistant Agricultural Economist on the Giannini Foundation, University of California, College of Agriculture, Davis.

4. Rice can tolerate more alkaline or saline soil, and the soil may be improved by the leaching of salts during rice production.
5. Weeds that would compete with other crops are killed by the standing water.

## Soils Used for Rice Growing in the Sacramento Valley are Primarily Those With Defects for Other Uses

The Sacramento Valley has approximately 950,000 acres of clay type soils with restricted or poor drainage. Large areas of these poorly drained soils have their productivity reduced further by the presence of harmful concentrations of alkali or other salts. Not all of these clay soil areas are cultivated. Some are used for noncultivated pasture only. Some are in wildlife refuges. A large fraction of the "heavy" soil area is farmed, however, and rice is the principal crop grown.

Important soil series.--Approximately 450,000 acres of the clay and clay adobe soils are in the Sacramento, Stockton and Willows Series--the major rice growing soils. In addition, large acreages of the Gridley, Landlow, Marvin, Genevra, Colusa and other series are or have been used for rice production.

Location and origin of soils.--All of the soils on the floor of the Sacramento Valley have been deposited by flood waters. The Sacramento River has built up a flood plain of recently deposited sandy and sandy loam soil. During the past centuries the overflow of the river has spilled into troughs of lower elevation running parallel to the raised river bed. Streams draining from the foothills along the Valley have added flood waters to the basins caused by river overflow. Waters trapped in these low basin areas deposited fine particles to form the large areas of flat clay soil existing today.

A system of levees and drainage channels now prevents the annual flooding of the basin areas, but the two important soil defects, poor

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## Land Uses for Rice Production in the Sacramento Valley are Primarily Three

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Heavy soil areas.--Approximately 400,000 acres of the clay and clay loam soils are in the Sacramento, Stockton and Willows Series--the major rice growing soils. In addition, large acreages of the Colusa, Capay, Marvin, Clayey, Colusa and other series are or have been used for

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drainage and harmful salt concentrations, remain as a result of the alternate flooding and drying of the basins in past years. Drainage is hindered by flat topography and the slope of the land from the river flood plains to the bottoms of the basins.

Natural land divisions.-- Soil on which rice is grown may be grouped according to their location within three major natural land divisions.

1. Alluvial fan and flood plain soils lie adjacent to the Sacramento River, its tributary streams, and the sloughs that carried flood waters out of the river. These are the most recent soils. They are for the most part deep permeable, well-drained, coarse-textured soils that are adapted to economic production of a wide range of crops. Soils in this group have not been widely used for producing rice except where overwash phases of these coarse-textured soils are underlain with clay type basin soils at depths that make orchard planting and deep-rooted field crops uneconomical.
2. Basin soils lie in the bottom of the troughs. They are fine-textured, poorly-drained soils and large areas are used only for production of pasture or rice. Some have a wider range of use, but all are more limited in use than either the more recently formed soils along the waterways or the older soils along the foothills.
3. Terrace soils lie between the rolling land of the foothills and the flat basins. They are the remains of older valley fill or drainage fans of streams from the foothill areas. Characteristics of these soils are more variable than either the basin or recent flood plain soils. Crop uses range from nonirrigated pasture and grain to rice or irrigated forage crops.

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## Rainfall and Temperature Influence the Organization of Rice Farms, and the Nature and Timing of Cultural Operations[1]

Amount of rainfall.--The annual average rainfall in inches per season at seven stations in the rice farming area of the Sacramento Valley for 74 years of record is as follows:

| | | | |
|---|---|---|---|
| Sacramento . . . | 16.79 | Willows . . . . | 16.64 |
| Davis. . . . . | 16.72 | Hamilton City. . | 19.69 |
| Woodland. . . . | 17.44 | Chico . . . . . | 24.27 |
| Colusa. . . . . | 15.95 | | |

The amount of moisture available from this rainfall in most years is barely adequate for dry farming of small grains. In years of slight rainfall it has proved inadequate for all nonirrigated crops.

Fluctuations in amount of rainfall.--Rainfall varies erratically from year to year and in seasonal distribution. For the Colusa weather station, which is in approximately the center of the area geographically, recordings for the 24-year period 1930-1954 show a low of 6.38 inches in 1939 and a high of 30.43 inches in 1941. Other stations also show wide variations.

Monthly distribution of rainfall.--For a 74-year period the average precipitation recorded at the Colusa station in inches per month was as follows:

| | | | |
|---|---|---|---|
| January....3.09 | April.....1.10 | July.....0.01 | October....0.69 |
| February...2.89 | May.....0.57 | August.....0.01 | November...1.62 |
| March.....2.19 | June.....0.27 | September..0.28 | December...3.23 |

Actual rainfall in any given year fluctuates widely around these averages. During the 24-year period 1930-1954, January rainfall recorded at Colusa varied from less than ½ inch to more than 7.5 inches. The lack of rainfall in the summer months forces farmers to irrigate rice and other crops grown during this dry period.

1/ Data on climate given in the following section are taken from the appropriate annual and monthly issues of: U. S. Weather Bureau, Climatological Data, California, XXXIII-LX (Washington).

Distribution within important months.--Distribution during the periods when seedbed preparation or harvest operations for rice are being carried out is of vital concern. March rainfall at Colusa was less than 0.5 inches in 3 of the 1930-1954 years. At the other extreme, 7 of these 24 years had more than 3 inches of rainfall during the month of March.

Weather records show that in 8 of the 24 years, or 1 year in 3, less than 0.25 of an inch of rain fell during the last ten days of March. Six of the same 24 years, or 1 in 4, had over 1.5 inches during this critical ten-day period. In 8 of the 24 years, more than 0.5 inches of rain fell in a single 24-hour period.

Rains of this magnitude in March and April drench the hard-to-drain clay soils and interrupt or delay field operations. Farmers producing rice on the poorly-drained basin soils reported that they do not plan to begin preparation of a seedbed for rice during the month of March and in wet years not until the latter half of April. Those farmers producing rice on better drained soils are able to begin operations at an earlier date.

During the harvest season, heavy rains may cause the loss of rice through shattering, lodging, or abandonment. Rains delay harvest and make operations more difficult and costly by wetting the rice and by keeping the fields muddy.

The long-run average for October at the Colusa station is 0.69 inches. Fluctuations in rainfall during the three ten-day periods in the month for the 24 years 1930-1954 were as follows:

| | 0.25 inches or more | 0.75 inches or more |
|---|---|---|
| | Number of years occurring out of 24 | |
| October 1-10 | 3 | 1 |
| 11-20 | 7 | 1 |
| 21-31 | 7 | 6 |

The rainfall during the third of these periods is likely to fall in heavy storms. Six of the 24 years had recordings of 0.75 inches or more in a single

[illegible] within [illegible].--[illegible] during the periods for seedbed preparation and harvest operations for rice [illegible] of vital concern. [illegible] rainfall at [illegible] than 0.5 inches [illegible] the 1930-1953 [illegible]. At the other extreme, 7 of these 24 years had [illegible] 3 inches of rainfall during the month of March.

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The [illegible] average for [illegible] 0.[illegible] inches. [illegible] rainfall during [illegible] periods in the month for the [illegible] years 1930-1953 [illegible] as follows:

[illegible]

The rainfall during the third of these periods is likely to fall in heavy [illegible]. Six of the 24 years had [illegible] of 0.[illegible] inches or more in a single

24 hours between October 21-31, and 5 years had 1 inch or more in 24 hours between these dates.

Temperature.--Temperature is seldom a limiting factor in production of the common field crops. Temperature at specific times during the year, however, can be a critical factor in rice production.

During May and June, lower than normal temperatures slow the growth of the rice plant. One result is a longer growing season. This may be overcome by higher than normal temperatures in mid and late summer. Another result is a weaker rice seedling that is less able to compete with weed and insect pests. Irrigation costs will be increased if it becomes necessary to alter practices, for example to completely drain a field in cool weather in order to stimulate growth of the rice plants. This normally leads to added costs of weed control also, because the weeds as well as the rice may be stimulated by draining.[1/]

Long-run temperature records at Colusa show the following in degrees Fahrenheit:

| | Jan. | Feb. | Mar. | Apr. | May. | Jun. | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average maximum | 53 | 59 | 65 | 71 | 79 | 88 | 94 | 92 | 84 | 75 | 64 | 54 |
| Average minimum | 38 | 40 | 43 | 46 | 51 | 57 | 60 | 58 | 54 | 48 | 41 | 37 |
| Highest | 74 | 78 | 88 | 93 | 101 | 109 | 112 | 109 | 106 | 99 | 84 | 74 |
| Lowest | 19 | 23 | 26 | 29 | 32 | 38 | 48 | 49 | 41 | 31 | 24 | 18 |

Temperature and pollination of rice.--A second and normally more critical period of temperature-growth relationships occurs between mid-August and mid-September when the self-pollinating rice plants flower.

Any field of rice can be expected to complete flowering and pollination within approximately a one-week period when temperatures are above 55° Fahrenheit. If minimum temperatures fall below 50° Fahrenheit at the time

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1/ Information obtained from farm interviews over period 1951-1954.

50 days between October 15-30), and 5 years has 1 inch or more in 24 hours [illegible] .

Damaging cold.--Low or [illegible] is [illegible] a limiting factor in production of the common field crops. Temperatures at specific times during the year, however, can be a critical factor in rice production.

During May and June, [illegible] than normal temperatures flow the growth of the rice plant. The result is a longer growing season. This may be [illegible] [illegible] normal temperatures in mid and late summer. Another result is a shorter rice growing that is less able to compete with weed and insect pests. In [illegible] costs will be increased if it becomes necessary to [illegible] [illegible], for example to completely drain a field in cool weather in order to eliminate growth of the rice plant. This normally leads to added costs of weed control. Also, however, the [illegible] as well as the rice may be [illegible] by drainage.[1]

Temperature [illegible] at various [illegible] are [illegible]

[illegible]:

| | Jan. | Feb. | Mar. | Apr. | May | Jun. | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 88 | 94 | 94 | 74 | 72 | [illegible] |
| [illegible] | [illegible] | 40 | [illegible] | 46 | [illegible] | 57 | 60 | 58 | 54 | 47 | [illegible] | [illegible] |
| [illegible] | 74 | 78 | 80 | [illegible] | 101 | 107 | 112 | 109 | 106 | 79 | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 44 | 44 | 41 | 31 | 14 |

[illegible] and [illegible] of [illegible].--A second and normally more critical period of temperature-growth relationship occurs between mid-August and mid-September when the well-[illegible] rice plants flower.

The yield of rice can be reduced to complete flowering and pollination [illegible] immediately a cool-weather period when temperatures are above 70° Fahrenheit. If maximum temperatures fall below 70° Fahrenheit at the time

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[1] Information obtained from farm interviews over period 1951-1954.

of flowering the pollen tubes may fail to form and rice flowers are not fertilized, consequently no rice kernel develops. Growers commonly refer to this condition as "straighthead" or "blighting." A difference of a few days in the planting date of a field can make the difference between a good yield or no yield if the flowering dates coincide with a period of low temperatures.[1/]

Late planting, or retarded growth from cool weather or excess nitrogen fertilization, may delay flowering until summer temperatures fall below the critical point. Temperatures below 50° F. for only a few hours will cause flowers in bloom at the time to be sterile. A period of prolonged low temperatures during mid-summer will affect many fields. This occurred in 1954, causing substantial acreages to be abandoned because yields promised to be too low to cover costs of harvesting.

Temperature and harvest.--Temperatures in September and October affect the ease of harvesting and the quality of the rice. The speed with which fields dry after draining is affected by temperatures during this time; a dry field is easier and less costly to harvest. Moisture content of maturing rice kernels also drops faster when air temperatures are high. Generally, rice is not combined until moisture content drops to 25 per cent or below. Cool moist weather retards the drop in kernel moisture, and, if prolonged, may delay harvest until after the onset of fall rains.

Too high temperature at harvest time, in contrast, may dry unharvested rice too fast. Checking of the kernels, which is likely to result, increases the number of kernels broken in milling and lowers the price received for the rice. Acceleration of harvesting appears to be the only way to offset this potential loss.

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1/ Davis, Loren L. California Rice Production, California Agricultural Extension Service Circular 163. Berkeley, 1950.

## Farmers Growing Rice in the Sacramento Valley Have Organized Their Farms and Adapted Their Operations to Control Adverse Biological Conditions and Realize the Benefits of Favorable Ones

Adverse biological conditions.--Weeds and insects are the principal adverse biological factors. Control has been accomplished by alternating crops and by use of chemicals.

Submerging land for rice gives good control of weeds such as morning glory that normally must have reasonably dry soil. Control of some water-loving weeds also is accomplished by leaving the land idle for a season between rice crops to dry the soil thoroughly or using it for crops such as barley that do not usually require irrigation.

Some broad leafed water-loving weeds have been controlled by spraying with weed-killing chemicals. Careful management of the water level at planting time has permitted continuous cropping to rice on some fields during the past five to ten years, in spite of the danger of increased competition from water grass--the most prevalent weed pest.

Insects.--Harmful effects of the major insect pests are generally controlled by spraying or dusting with poisonous chemicals. Incidence of these pests varies, and treatment is based on conditions in individual fields. Economical treatments are available for all insect pests that seriously attack rice.

In some years weather conditions increase the cost of controlling pests. Unusually cool temperatures in May favors a build-up in the population of the rice leaf miner (*Hydrellia griseola* vos. *scapularis* Loew) to the point where stands in many field may be threatened. The control involves draining of the fields, spraying with a solution of dieldrin or heptachlor and reflooding to the normal level.

Muskrats.--Muskrats have been spreading over the rice producing area during the past 15 years. These small aquatic rodents burrow into levees and ditch banks. The resulting leaks or breaks drain fields and require costly repairs. Stands

of rice and other crops are damaged from lack of irrigation water.

Shooting and trapping have failed to halt the increase of these pests. To prevent more costly damage from breaks, growers rebuild levees oftener than would be necessary if they were not weakened by muskrat burrows.

Ducks and other wild waterfowl.--Wild fowl are a serious menace to ripening rice crops, and at certain times to irrigated pastures. The Sacramento Valley is a major north-south flyway for migratory waterfowl. The arrival of large numbers of birds in the rice growing area in September and October coincides with the maturing and harvesting period for rice.

Growers attempt to protect their rice by scaring away flocks of ducks that alight in their fields and by paying pilots to herd large flocks away from rice fields with airplanes.

Good drainage and even stands that reduce the area of open water make rice fields less attractive to feeding ducks and geese.

Favorable biological factors.--The availability of well adapted varieties is the most favorable biological factor affecting rice farming in the Sacramento Valley. Soil and weather conditions that permit the use of green manure crops and the complementary relationships between rice and legume crops have been used by some growers to good advantage.

The most important variety.-- Caloro, the most widely grown California rice variety, is a short grain type. It is well adapted to all of the rice growing sections of the Sacramento and San Joaquin Valleys and yields well under a wide range of conditions.

Caloro generally matures in about 150-155 days after planting. It has the desirable characteristic of shortening its growing season when planted late. For 42 fields of Caloro on survey farms in 1950, the average of elapsed time from seeding to the beginning of harvest, as shown in Table 1, was 161 days.[1/]

---

1/ It is possible that in some cases, at least, the field may have been "mature" one or more days before combining began.

TABLE 1

Average Length of Growing Season For 42 Fields of Caloro Rice, 1950

| | Days |
|---|---|
| Average of elapsed time from seeding | 161 |
| Greatest elapsed time--field seeded April 6 | 178 |
| Shortest elapsed time--field seeded May 20 | 143 |
| Fields seeded April 20-24 | 159-172 |
| Fields seeded May 5-9 | 148-166 |
| Fields seeded May 15-20 | 143-153 |

Source: Compiled from records obtained in interviews with farmers.

Correlation of data on planting date with elapsed days from seeding to harvest for the 42 fields summarized in Table 1 indicates that for every day that seeding was delayed during the usual planting season, the elapsed time needed to mature a crop was shortened by approximately 0.6 days.[1/]

Planting date is only one of many factors affecting elapsed time from seeding to harvest. Another important variable that can be controlled to a certain extent is the fertility of the soil. Higher fertility tends to lengthen growing season. Drainage date also is important; some growers interviewed hastened maturity by draining fields during August.

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1/ The estimating equation for growing time required is $Y_c = 180.020 - .587 (X)$ when $Y_c$ equals estimated days from seeding to harvest and X is the number of days after March 31 before seeding.

$$Y_s = 6.0 \text{ days and } r^2 = .44.$$

With 1950 weather conditions growing time required for plantings on May 1 and May 20 would be as follows:

| Planting date | Estimated growing time | Estimated date to begin harvest |
|---|---|---|
| | days | |
| May 1 | 162 | October 9 |
| May 20 | 150 | October 17 |

Short growing season variety.-- When fields are planted late in May another short-grain variety, Colusa, may be used because it has a shorter growing season than Caloro. Its usual season is 135-140 days from planting--and is not shortened by late planting.

Some farmers have preferred Colusa in recent years for planting on very fertile land where it is more likely than Caloro to mature. Only 3 of 75 growers interviewed used this variety in 1950 even though it was first introduced in 1917. There has been more interest in it in years since 1950 as old clover fields have been planted to rice, but difficulties in obtaining Colusa seed and lower yields under normal conditions have caused most growers to plant Caloro.

A medium grain variety.--California acreage of Calrose, a medium grain variety, increased during the period covered by this study. Eight of the 75 growers interviewed had grown this variety on part or all of their acreage in 1950. This is a relatively new variety, having been grown commercially for the first time in 1948. By 1954, the estimated acreage of Calrose in the five principal Sacramento rice growing counties had increased to 13,737.[1/]

Calrose has yeilded as well as Caloro. It matures evenly, adjusts growing season to date of planting, and is as easy to harvest. Its price premimum of 25¢ or more per hunderdweight over the short-grain varieties has been offset somewhat, however, by the inconvenience of securing drying and storage facilities that would not mix the two classes. Handling services have been increased since 1950 and growers expressed intentions to grow relatively more of the medium-grain rice in the future.[2/]

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1/ Rice Acreage in the United States, 1954, The Rice Millers Association, New Orleans, 1954.

2/ All of these varieties have been developed and tested at the Biggs Rice Field Station. Improved seed and experimental results on cultural practices have been available from this station. Varieties grown in other rice growing areas are being tested continually, but have not proved to be as well adapted as Caloro, Colusa and Calrose. The long and medium grain varieties grown in the Gulf Coastal states yield less than these three.

## LAND USE IN THE SACRAMENTO VALLEY AND ORGANIZATION OF INDIVIDUAL FARMS IS GREATLY AFFECTED BY ECONOMIC DETERMINANTS THAT ARE EXTERNAL TO THE INDIVIDUAL FARM BUSINESSES

### Small Grains have Dominated the History of Crop Production in the Area

Throughout the history of farming in the Sacramento Valley small grain farming and permanent pasture have been the principal land use, with wheat and barley the principal nonirrigated small grain crops.

Rice was successfully introduced into the area in 1912. Big increases in demand caused by World War I led to a rapid expansion in rice acreage. Since 1920 acreage devoted to the three crops, rice, wheat and barley have fluctuated, but their combined acreage has been equal to approximately 80 per cent of all cropland harvested. Since 1950 safflower--an annual oil producing plant--has replaced the nonirrigated cereals on five to ten per cent of the cropland.[1/]

Other crops of importance.--Alfalfa, sugar beets, and irrigated pasture have been other major users of land, but no other single crop approaches rice, wheat, or barley in acreage planted. Fruit and nut crops compete for the deep friable soils adjacent to the rivers and sloughs.

### Special Machinery and Services Required in Rice Production Have Been Developed in the Sacramento Valley

Airplane operator are hired on a contract basis for seeding, fertilizing or application of spray material to rice and other crops, while special surface-operating rice machinery also is available for rent. Rice dryers, both commercially owned and farmer owned, provide drying and storage space.

A farmer who does not operate a sufficient acreage to justify owning special machine, may contract to have the necessary job performed for him. Service and maintenance facilities are commercially available for all farm machinery.

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1/ Data from Annual Agricultural Crop Reports, prepared annually by the Agricultural Commissioners of the Sacramento Valley counties.

The acreage reduction forced by allotments beginning in 1955 makes it even easier for an individual farm operator to secure hired or contract equipment at the time when needed. This reduction may eventually make available secondhand machinery which may be obtained at a price well below that for items purchased new.

The long history of production of the principal crops in the area also assures that full technical information is readily available through the Agricultural Extension Service and through the field service agencies of many commercial concerns. Some experimentation is done within the counties by the College of Agriculture Extension Service and by the Agricultural Experiment Station personnel from the University of California at Davis. In addition, the United States Department of Agriculture Rice Field Station at Biggs, California, is in constant touch with the latest cultural problems of the area.

Availability of irrigation water.--Although summer rainfall provides little moisture for rice production in the Sacramento Valley, large quantities of irrigation water are available. Runoff water from winter rain and snows in the watersheds draining into the Valley are stored naturally or in man-made dams for summer use. Publicly organized irrigation districts supply irrigation water and collect and remove drainage water. For water taken from the canals for use on his farm the landowner pays a charge plus a share in upkeep and maintenance of installations. Farmers who are not supplied by irrigation districts may pump water directly from the Sacramento or other rivers, from a drainage canal, or from wells drilled on their own property.

The public flood control and water supply systems relieve the farmer of protecting or supplying his own farm. This system provides over-all coordination of water management.

Land tenure.--Specialized knowledge and machinery are required for growing the principal field crops in the area. Producers of rice, sugar beets, and other

crops may, therefore, invest their capital in operating equipment rather than in land, and lease land from large landholders or from other farmers who cannot or do not wish to invest in the specialized equipment required for production of these crops. Many farmers prefer to lease a part of their acreage to a specialist rather than personally undertake the investment and risk required in production.[1/]

TABLE 2

Distribution of Growers and Acreages of Rice in 1950 Among Farmers Producing Rice on Owned Land Only, on Rented Land Only and on Both Owned and Rented Land in the Five Principal Rice Growing Counties.

| | Butte Co. | | Colusa Co. | | Glenn Co. | | Sutter Co. | | Yolo Co. | | Total | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | Acreage | No. | Acreage | No. | Acreage | No. | Acreage | No. | Acreage | No. | Acreage |
| Owner only | 96 | 25,697 | 35 | 6,558 | 34 | 6,546 | 62 | 11,881 | 4 | 449 | 231 | 51,131 |
| Owner & tenant | 25 | 9,624 | 24 | 10,372 | 22 | 9,279 | 31 | 14,787 | 11 | 9,036 | 113 | 53,098 |
| Tenant only | 50 | 10,060 | 107 | 31,152 | 61 | 10,492 | 82 | 16,522 | 37 | 19,082 | 337 | 87,308 |
| Total | 171 | 45,381 | 166 | 48,082 | 117 | 26,317 | 175 | 43,190 | 52 | 28,567 | 681 | 191,537 |

Source: Compiled from records obtained from the offices of the Secretaries of County Agricultural Stabilization and Conservation (ASC) Committees.

In the five principal rice growing counties in 1950, Butte, Colusa, Glenn, Sutter, and Yolo, 231 - or 33 per cent - of the growers of rice were operating on owned land only. Forty-nine per cent of the growers were producing rice on leased land only. The remaining 18 per cent of the growers were producing rice on leased land as well as on land they owned. Data on number of growers by type of tenure and acreage for each type are shown in Table 2.

The importance of tenancy in rice production is further emphasized by the fact that the 231 owners average 221 acres of rice per farm compared with 260

1/ Information obtained in interviews with farm owners and tenants.

acres for 337 tenants. The largest average acreage per farm, 470, occurred in the group of 113 growers who produced rice on leased as well as on owned land.

Prices Paid for Items Used in Production Have Increased Greatly in Recent Years

Land.--Land prices have increased greatly in the Sacramento Valley during the past twenty years. During the period 1950-1953 buyers paid from $200 to $300 per acre for producing rice land that may have sold for as little as $15 per acre in the early 1930's. The difference represented partly in inflated price of land but also the improvements in the form of better drainage, levelling, and leaching of salts that have occurred as the land has been developed and used in rice production. Some of the more adaptable soils used in rice production have sold for as much as $450 per acre.

Rent paid for land used in rice production has ranged upward from $5 to $10 per acre cash rent to one-third or more of the crop produced. In recent years conditions tied to some share-rental leases, such as requirements for land levelling or improved drainage, have raised the rent above one-third of the crop. The increase in land rental has caused some tenants to attempt to purchase land on their own. This tendency has been discouraged by the increase in price of land, but many rice growers have purchased land since 1950. Continued favorable prices for rice have permitted tenants, after building up an extensive inventory of operating equipment, to invest earned capital in land. The favorable prices for agricultural products, on the other hand, have also caused landowners to retain their land rather than offer it to the market at the prices prevailing.[1/]

Labor availability and wages paid.--Wages per day in the state of California have increased rapidly. The 1952 average wage paid was 327 per cent of that paid during the period 1935-1939, Table 3. Of all the commodities and investment goods required in farm production in the Sacramento Valley, labor has shown the greatest increase in cost per unit. In general, the quality of the

1/ Information obtained from farmers, county Agricultural Stabilization and Conservation Committee personnel and real estate brokers.

labor required in rice production has increased with increased mechanization and the actual wages paid may have increased more than the 327 per cent average for the state as a whole.

During the rice harvest, the period of greatest hired labor needs, wages paid range from $12 to $25 per day. As a result of the shortage of trained sack sewers and the high wages required to obtain any one for this job, nearly all growers have changed to bulk handling of rice and other grains. In addition, self-propelled harvesters, automatic balers, and mechanical sugar beet machinery have further reduced the need for seasonal hired labor. Farmers interviewed gave both shortage of labor and high wage rates as reasons for investing in labor saving equipment.

Capital.--The prices paid for machinery and other capital items used in production have also increased but to a lesser degree than those for labor and land. Prices paid for wheel tractors in 1952 were 189 per cent of the 1935-1939 figure. Combines have risen to 203 per cent, tillage machinery to 214-251 per cent. Because of the increase in wages, farmers attempted to obtain larger tractors and other equipment and provide more of the labor required in production of the major crops. Change in availability of labor also caused them to switch to machinery that would permit them to hire a smaller number of better trained workers for use in production.

Fertilizer and other supplies.--Of the items used in production, fuels increased in price the least during this period with gasoline going up by 39 per cent and diesel fuel slightly more. The price of ammonium sulphate increased by 80 per cent between 1935-1939 and 1952.

TABLE 3

Average Prices Paid for Selected Items Used in Production, 1935-1939, 1945 and 1952, and Percentages of 1935-1939 Averages

| Item | 1935-39 a/ | | 1945 a/ | 1950 b/ | 1952 a/ | |
|---|---|---|---|---|---|---|
| | Price | Per-cent | Per-cent | Per-cent | Per-cent | Price |
| | Dollars | | | | | Dollars |
| Crawler tractor, 3 plow | 1,500 | 100 | 138 | 233 | -- | -- |
| Wheel tractor, 20-29 h.p. | 1,060 | 100 | 113 | 173 | 189 | 1,990 |
| 1 1/2 ton truck | 918 | 100 | 166 | 223 | 254 | 2,330 |
| Combine 12' cut | 1,670 | 100 | 120 | 175 | 203 | 3,400 |
| Plow tractor, 3 bottom | 156 | 100 | 116 | 208 | 233 | 363 |
| Spiketooth harrow, section | 11 | 100 | 119 | 203 | 245 | 28 |
| Ammonium sulfate (ton) | 37 | 100 | 125 | 172 | 180 | 67 |
| Wages per day, w/out board | 3 | 100 | 288 | 288 | 327 | 11 |
| | Cents | | | | | Cents |
| Gasoline (gallons) | 19.2 | 100 | 103 | 136 | 139 | 26.6 |
| Distillate (gallons) | 8.4 | 100 | 108 | 183 | 185 | 15.6 |

a/ All data are national averages except ammonium sulfate and wages which are averages for California. Prices 1935-1939 and base for calculating index for 1945 taken from: Agricultural Prices. (Washington: Bureau of Agricultural Economics, U. S. Department of Agriculture, March 29, 1950). pp. 34-35.

b/ Prices for 1950 and 1952 obtained from monthly issues of Agricultural Prices.

c/ These prices for items may be lower than those paid for items used in rice production, e.g., the combined price of $3,400 listed does not include: (1) the cost of bulk handling equipment for rice which is more expensive than sacking equipment, (2) replacements of rubber tires with tracks for operation in mud, and (3) general strengthening of structural members.

Source: Bureau of Agricultural Economics, U. S. Department of Agriculture, Farm Wage Rates by States, Revised, 1910-1948, (Washington, Bureau of Agricultural Economics, U. S. Department of Agriculture, January 1951) p. 73. Bureau of Agricultural Economics, U. S. Department of Agriculture, Farm Labor, (Washington: Bureau of Agricultural Economics, U. S. Department of Agriculture, January 1951 to October 1952).

## For Much of the Potential Production of the Sacramento Valley the Markets Lie Outside of the Valley

The principal markets for many of the crops adapted to physical conditions in the Sacramento Valley lie outside of the Valley and for some such as rice, lie outside of the continental limits of the United States. This distance from the markets is offset by the low cost transportation available to the area. The navigable Sacramento River and railway lines provide means for moving the bulky products, such as grain, to nearby seaports. Grass and legume seeds move into interstate commerce by way of rail lines. In addition, the area is served by modern highways which permit movement of many farm products to nearby metropolitan areas and seaports by trucks. The area has adequate gravel and hard surface roads over which farm products can easily be hauled to the public transportation systems. Grain drying and storage plants, beet dumps, and seed processing houses are located on the highways, the two rail lines, and the river within easy reach of the farms.

Prior to World War II the principal markets for California rice were the off-shore territories of Hawaii and Puerto Rico. During the marketing years 1935-36 to 1938-39 shipment of milled head rice to these two markets varied from 66 to 81 per cent of the total supplies available for shipment from California farms. As late as 1941-42, 70 per cent of the production went to these markets. During the war years distribution was affected by shipments involving the armed services and other Federal agencies so that percentage figures do not give the true picture of what happened in those years. In the 1945-46 season 41 per cent of total supplies was shipped to the Hawaii and Puerto Rico markets and this figure increased until 1950-51 when 58 per cent went into these channels. With the greatly increased supply available in 1951-52, only 35 per cent went to these two markets although the absolute quantity shipped was greater than in all but the previous two seasons.[1/]

1/ For detailed information on the distribution of California grown rice see the annual releases: Agricultural Marketing Service, Grain Division, Annual Market Summary of California Rice (San Francisco: Federal State Market News Service, November 1956 and earlier years.)

The decline in percentage of California supplies going to these off-shore territories reflects the great increase in total supplies available rather than a decrease in total shipments. The territorial markets are highly important outlets but larger amounts, both absolutely and relatively, have been going into export markets in recent years.

Exports of California grown rice were 3,635,000 hundredweight in 1951-52, compared with an average of 873,000 in the preceding ten years. The very significant aspect of this export situation lies in the fact that 3,283,000 hundredweight, or 90 per cent of the total amount exported, went to one country, Japan. These changes in the production and distribution of California rice have been taking place since the war in the Far East severed the main trade routes near the close of 1941. World rice production fell but has since regained its original level. Total demand for rice, however, has increased with increased population and rice growers find Japan in a market of increased and lasting importance.[1/]

This increased importance of the export markets means that California growers will be influenced more by production in the other principal exporting areas and also by the availability of dollar exchange to Japan and other importing countries.[2/]

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1/ Ibid.

2/ For an analysis of export markets for U. S. rice and changes in marketing that have taken place, see: Mehren, G. L. and Nicholas Thuroczy, The Market for United States Rice: Foreign. Calif. Agr. Exp. Sta., Giannini Foundation of Agricultural Economics, Mimeo. Report No. 163, March 1954.

[illegible] in percentage of California rice going to the [illegible] territories reflects the [illegible] supplies available to [illegible] in [illegible]. The territorial markets are highly important outlets, but larger amounts, both absolutely and relatively, have been going into export markets in recent years.

[illegible] of California-grown rice [illegible] 2,[illegible] bags in 1948-49, compared with an average of 672,[illegible] in the preceding ten years. The very significance of this export situation lies in the fact that 3,[illegible] bags, [illegible] per cent of the total amount [illegible], went to one country, Japan. These changes in the production and distribution of California rice have been taking place since the war in the Far East [illegible] the main trade routes [illegible] [illegible] rice production fell [illegible] original level. Local demand for rice, however, has increased with increased population, and rice growers find Japan is a market of increased and lasting [illegible].[1]

This increased importance of the export market means that California growers will be influenced more by production in the other principal exporting [illegible] and also by the availability of dollar exchange in Japan and other [illegible].

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[1] [illegible] analysis of export markets for U. S. rice and changes in [illegible]

Prices Received for Rice By California Growers Have Fluctuated Greatly as a Result of the Changed Conditions of Supply and Demand

Table 4 shows estimated average prices received for rice crops produced from 1931 to 1955. During the last half of the 1931 crop year prices went as low as 56 cents per hundredweight with an average for the season of $ .89. From this low they recovered to a five year, 1935-1939, average of $1.36.

Prices received for rice increased greatly with the increased demand during World War II. With price control in force the average prices received ranged from $3.20 to $3.67 during the wartime years. With removal of price control average prices received soared to $4.80 for the 1946 crop season. The highest postwar price received was in 1952 when the season average prices received rose to $6.25 or 459 per cent of that received during the 1935-1939 period. The lowest post-war price, $3.42 was received in 1949, but prices declined again after the 1952 season. The estimated season's average price for 1957 crop rice is $4.50 per hundredweight.[1/]

The high prices immediately following World War II permitted rice growers to make the adjustments in capital investment necessary to offset the relatively greater increase in the cost of labor and the decreased availability of suitable labor. Lower prices in 1949 and 1950 caused rice growers to expect that the period of very high prices had ended. The advent of hostilities in Korea brought continued unrest in other parts of the Orient, however, and caused prices to rise above their 1949-50 levels. During this period of continued high prices, rice growers continued to improve their inventories of equipment and their land. Many adjustments were made that would not have been possible with lower prices.[2/]

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1/ California Crop and Livestock Reporting Service, California Field Crops 1957 Annual Summary, December 27, 1957.

2/ Based on personal observations, interviews with farmers, and data from U. S. Department of Agriculture, Annual Market Summary for California Rice.

TABLE 4

Estimated Average Prices Per Hundredweight Received by California Producers for Rough Rice, Season Beginning October 1 1931-1955

| Crop year | Price | Crop year | Price |
|---|---|---|---|
| 1931-32 | $ .89 | 1943-44 | $ 3.64 |
| 1932-33 | .91 | 1944-45 | 3.67 |
| 1933-34 | 1.58 | 1945-46 | 3.64 |
| 1934-35 | 1.49 | 1946-47 | 4.80 |
| 1935-36 | 1.49 | 1947-48 | 6.13 |
| 1936-37 | 1.47 | 1948-49 | 4.40 |
| 1937-38 | 1.29 | 1949-50 | 3.42 |
| 1938-39 | 1.24 | 1950-51 | 4.54 |
| 1939-40 | 1.31 | 1951-52 | 4.95 |
| 1940-41 | 1.53 | 1952-53 | 6.25 |
| 1941-42 | 3.20 | 1953-54 | 5.38 |
| 1942-43 | 3.49 | 1954-55 | 4.70 |
| | | 1955-56 | 4.50 a/ |

a/ Preliminary

Source: Agricultural Marketing Service, Grain Division, Annual Market Summary of California Rice, (San Francisco: Federal State Market News Service) November 30, 1956.

For the most part, the prices received for other crops have advanced less since World War II than the prices received for rice. To document this point, Table 5 presents data on prices received for selected commodities in Colusa County, the principal rice growing county throughout this period. The prices for the principal alternative crops, barley and wheat, advanced after 1945 but only in 1946 and 1949 did they show an equal to or greater increase than rice. Prices received for rice in 1947 were more than twice those received in 1945 according to data published by the County Agricultural Commissioner. By 1954 prices received for rice were still 138 per cent of the 1945 price but prices received for barley had slipped to only 96 per cent of prices in the earlier year. Of the other principal crops grown, both alfalfa seed and ladino clover seed have shown a marked decrease in price since 1945.

These decreases or relatively smaller increases in the price of other commodities have been a further influence causing farmers to increase their production of rice.

[illegible]

TABLE 5

Average Prices Received in 1945 and 1954 for Selected Agricultural Commodities in Colusa County and Percentage Each Average Yearly Price 1946-1954 is of the 1945 Price

| Commodity | Unit | 1945 price | 1945 index | 1946 index | 1947 index | 1948 index | 1949 index | 1950 index | 1951 index | 1952 index | 1953 index | 1954 index | 1954 price |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | dollars | | | | | per cent | | | | | | dollars |
| Rice | Cwt. | 3.25 | 100 | 126 | 203 | 142 | 102 | 137 | 146 | 185 | 156 | 138 | 4.50 |
| Barley | Cwt. | 2.30 | 100 | 126 | 141 | 122 | 102 | 113 | 141 | 135 | 110 | 96 | 2.20 |
| Wheat | Cwt. | 2.57 | 100 | 132 | 146 | 136 | 126 | 136 | 144 | 144 | 134 | 132 | 3.40 |
| Oats | Cwt. | 2.30 | 100 | 130 | 148 | 141 | 130 | 130 | 152 | 150 | 135 | 102 | 2.35 |
| Milo | Cwt. | 2.34 | 100 | 118 | 182 | 118 | 112 | 118 | 139 | 132 | 111 | 111 | 2.60 |
| Pink beans | Cwt. | 6.65 | 100 | 180 | 210 | 142 | 109 | 128 | 117 | 154 | 135 | 113 | 7.50 |
| Sudan seed | Cwt. | 6.50 | 100 | 108 | 108 | 97 | 123 | 138 | 123 | 123 | 85 | 115 | 7.50 |
| Alfalfa seed | Lbs. | .36 | 100 | 100 | 67 | 83 | 69 | 54 | 58 | 61 | 64 | 69 | .25 |
| Ladino seed | Lbs. | 1.25 | 100 | 108 | 120 | 136 | 124 | 106 | 100 | 70 | 29 | 42 | .53 |
| Alfalfa hay | Ton | 20.00 | 100 | 125 | 115 | 115 | 125 | 90 | 120 | 120 | a/ | a/ | a/ |
| Sugar beets | Ton | 12.73 | 100 | 86 | 99 | 53 | 55 | 76 | 77 | 75 | 75 | 78 | 9.95 |

a/ Data not available.

Source: Annual Agricultural Reports, and Annual Reports Crop Statistics, County, Department of Agriculture. Colusa, California, 1945-1954.

Since 1933 All of the Major Crops Grown in the Rice Area Have Been Affected by Federal Laws Dealing With the Support of Commodity Prices, Acreage Allotments, Subsidy Payments, and Production Goals

Among the most important economic determinants of farm organization are the action programs of governmental agencies which by the force of law can impinge directly upon the organization and management of a farm. Both rice and wheat have been eligible for mandatory support through subsidy payments, nonrecourse loans, or purchase agreements because of a designation as "basic crops" under the agricultural laws of the past twenty years. Sugar beets have been grown under agreements allowing for subsidy payments during this entire period. Prices of other commodities have been supported under legislation permitting but not requiring the Secretary of Agriculture to render support. Incentives and restrictions under whic these and other crops have been produced since 1933 are listed in Table 6.

In general, farmers received subsidies in the form of direct payments during the first half of this period and by support of market prices during the second half. Nonrecourse loans or purchase agreements have been available from the Commodity Credit Corporation to producers of rice, wheat, barley, beans grain sorghums, hay and pasture seeds--primarily ladino clover and alfalfa--and winter cover crop seeds. These have had the dual effect of (1) guaranteeing the farmer the support price for his crops, and (2) permitting him to borrow against his produc (placed in suitable storage) while holding it in expectation of a higher price but with the option of redeeming or surrendering title in full settlement of loan.

Rice support activities.--Support prices were available throughout the period 1941 to 1957, but in many of those years there was little activity because of general market conditions. In fact, in 1943, 1944 and 1946, although the legal framework was available, support prices for rice were not announced because market prices were well above what the support level would have been. There also was little support activity during the first two years after the close of hostilities in World War II because of the high demand for rice in export markets. For 1948,

TABLE 6

Action Programs of the United States Department of Agriculture Applying to the Principal Crops Grown in the Sacramento Valley, by Years, 1933-1954

| Commodity and Program | Symbol | Crop Years When Program Was Active | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | '33 | '34 | '35 | '36 | '37 | '38 | '39 | '40 | '41 | '42 | '43 | '44 | '45 | '46 | '47 | '48 | '49 | '50 | '51 | '52 | '53 | '54 |
| RICE | | | | | | | | | | | | | | | | | | | | | | | |
| Subsidy payments....a/ | P | P | P | P | P | P | P | P | P | P | P | P | | | | | | | | | | | |
| Loans and/or purchases | L | | | | | | | | | L | L | L | L | L | L | L | L | L | L | L | L | L | L |
| Acreage allotments.... | A | | A | A | | | A | A | A | A | A | A | | | | | | | A | | | | |
| Production goals..... | G | | | | | | | | | | G | G | G | G | G | G | | | | | | | |
| WHEAT | | | | | | | | | | | | | | | | | | | | | | | |
| Subsidy payments..... | P | P | P | P | P | P | P | P | P | P | P | P | | | | | | | | | | | |
| Loans and/or purchases | L | | | | | | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L |
| Acreage allotments.... | A | | | | | | A | A | A | A | A | A | | | | | | | A | | | | A |
| Marketing quotas..... | Q | | | | | | | | | Q | Q | | | | | | | | | | | | |
| Production goals..... | G | | | | | | | | | | G | G | G | G | C | G | | | | | | | |
| Crop insurance..... | I | | | | | | | | I | I | I | I | | | I | | | I | I | I | I | | |
| BARLEY | | | | | | | | | | | | | | | | | | | | | | | |
| Loans and/or purchases | L | | | | | | | | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L |
| Production goals..... | G | | | | | | | | | | G | G | G | G | G | G | | | | | | | |
| BEANS | | | | | | | | | | | | | | | | | | | | | | | |
| Loans and/or purchases | L | | | | | | | | | | | L | L | L | L | L | L | L | L | L | L | L | L |
| Acreage allotments.... | A | | | | | | | | | | | | | | | | | | A | | | | |
| Production goals..... | G | | | | | | | | | | G | G | G | G | G | G | | | | | | | |
| GRAIN SORGHUMS | | | | | | | | | | | | | | | | | | | | | | | |
| Loans and/or purchases | L | | | | | | | | L | L | L | L | L | L | L | L | L | L | L | L | L | L | L |
| Production goals..... | G | | | | | | | | | | G | G | G | G | G | G | | | | | | | |
| VETCH AND PEA SEEDS | | | | | | | | | | | | | | | | | | | | | | | |
| Loans and/or purchases | L | | | | | | | | L | L | L | L | L | L | L | L | L | L | L | L | L | L | |
| Production goals..... | G | | | | | | | | | | | | G | G | G | G | | | | | | | |
| SUGAR BEETS | | | | | | | | | | | | | | | | | | | | | | | |
| Subsidy payments..... | P | | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| Acreage allotments.... | A | | A | A | | | A | A | A | | | | | | | | | | | | | | A |
| Production goals..... | G | | | | | | | | | | G | G | G | G | G | G | | | | | | | |
| LADINO CLOVER SEED | | | | | | | | | | | | | | | | | | | | | | | |
| Loans and/or purchases | L | | | | | | | | | | | L | L | L | L | | | L | L | L | L | | |
| Production goals..... | G | | | | | | | | | | | | G | G | G | G | | | | | | | |
| ALFALFA SEED | | | | | | | | | | | | | | | | | | | | | | | |
| Loans and/or purchases | L | | | | | | | | | | | L | L | L | L | L | L | L | L | L | L | | |
| Production goals..... | G | | | | | | | | | | | | G | G | G | G | | | | | | | |

Table 6 - continued.

a/ Nonrecourse loans for the purpose of holding commodities off the market, purchase agreements, and direct purchases made to reduce the supply available for commercial markets.

Source: U.S. Department of Agriculture, Report of the Administrator of the Agricultural Adjustment Administration, (Washington, 1933-1953).

U. S. Department of Agriculture, Agricultural Adjustment Administration, California State Office, Annual Report, A.A.A. (or P.M.A.) Farm Programs, (Berkeley, 1939-1952).

U. S. Department of Agriculture, Commodity Stablization Service, C.C.C. Price Support Statistical Handbook (Washington, November 1953).

Commodity Credit loans were made on 347 hundredweight only but purchase agreements on 937,000 hundredweight of California rice resulted in net acquisitions by the Commodity Credit Corporation of 600,000 hundredweight of rough rice.

Acquisitions during the 1949 crop year were much greater. With an increase of world supplies available and market prices the lowest since prewar, loan and purchase agreements were negotiated on over 46 per cent of the 1949 California crop. About one third of this amount was eventually acquired by the Commodity Credit Corporation in the form of milled rice.

Although loans and purchasing agreements were not actually negotiated in other years, the existing legislation assured growers that even if normal market channels would not absorb the entire production except at very low prices the Federal government would buy an unlimited quantity at a certain minimum price. The Commodity Credit Corporation would support the price by loans or purchase agreements.[1/]

Loan rates.--The relationship of loan rates for U. S. No. 1 California Pearl Rice--testing 48 pounds milled head and 70 pounds total milled rice placed in acceptable storage with charges paid up till April 1--and the average price per hundred pounds received by California producers.[2/]

Market prices fell below loan rates early in the 1954 marketing year. Growers placed 3,441,753, or approximately one third of the crop, under loan and purchase agreements. With prices advancing later in the season, all of the loans were paid off and no rice was tendered to the C.C.C.[3/] Market prices did not recover for the 1955 crop as in 1954, however, and approximately one fifth of the crop was turned over to the Commodity Credit Corporation in price support activities.[4/]

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1/ Data on price support activities are taken from the pertinent years issue of Agricultural Marketing Service, Grain Division, Annual Market Summary of California Rice, San Francisco, Federal-State Market News Service, 1933-1955.

2/ The 15th of each month calculated as a simple average to obtain these prices.

3/ Annual Market Summary, October 1955.

4/ Annual Market Summary, November 1956.

TABLE 7

Loan Rates for U. S. No. 1 Pearl Rice and Average Market Prices Received by California Growers, 1948-1955

| Marketing year | Loan rate | Season average price received |
|---|---|---|
| 1948 | $ 3.58 | $ 4.40 |
| 1949 | 3.49 | 3.42 |
| 1950 | 4.10 | 4.54 |
| 1951 | 4.61 | 4.95 |
| 1952 | 4.71 | 5.95 |
| 1953 | 4.56 | 5.10 |
| 1954 | 4.66 | 4.70 |
| 1955 | 4.38 | 4.50 a/ |

a/ Preliminary

Source: Agricultural Marketing Service, Grain Division, Annual Market Summary of California Rice, San Francisco, 1948-1956.

Growers used the machinery for price support in 1954 and 1955 and its effect on the market can be readily seen. Growers, as well as bankers and other businessmen interviewed during the course of this study, stressed the fact that the presence of price support machinery was having a significant influence on the organization and operation of the rice growing farms even in those years when market prices exceeded loan rates. Many operators could remember personally the drop in prices following World War I.[1] After World War II, the presence of the Commodity Credit Corporation to take over rice at loan rates, in case market prices collapsed, insured dealers in land, supplies, machinery, and short-term capital against the serious losses certain to result from a precipitous rice price decline. This assurance of a floor under prices permitted and encouraged growers to purchase the necessary equipment for expanding rice output at favorable post war prices.

Support on other crops.--Wheat has been supported continuously and large stocks have been acquired by the Commodity Credit Corporation. Other feed and

1/ Average prices received in January 1920 were $6.67 per hundredweight. By January 1921 they had fallen to $2.00. Annual Market Summary, November 1956.

forage crops have also been supported. Among these, ladino clover seed has made the greatest use of price supports. Average prices received by Colusa County growers reached a high of $1.70 in 1948 from which they declined to $1.00 in 1950; support prices were discontinued after the 1952 crop, and the average price received in 1953 was only 36 cents. With this price decline following the remova of support, ladino clover seed declined from its position as the highest paying alternative to rice on many soils in the Sacramento Valley.[1/]

Acreage allotments.--In conjunction with the price support activities, both wheat and rice have been subject to acreage allotments in recent years. Rice, wheat, and beans were all under allotment in 1950, allotments returned for wheat in 1954 and for rice in 1955, forced reduction in the acreage devoted to these crops caused alterations in farm organization and land use. The impact of acreage allotments will be analyzed in a later publication in this series.

Other programs.--In addition to the price support and acreage allotment programs, most of the crops grown in the rice area had designated production goals during the years 1942 to 1947 to guide their production (Table 6). These and subsidy payments that had been made earlier, and which have been continued for sugar beets, are generally incentive programs designed to improve the lot of the farmers producing the various crops.

Price support programs have also tended to increase output of the several crops involved. Acreage allotments now becoming more prominent have the opposite effect. One other Federal program under the title of "Agricultural Conservation' has also tended to increase production. Under this program, directed by a state committee and administered by local farmers within each county, farmers have been encouraged by subsidy payments to carry out certain practices that have tended to increase productivity. In the rice growing area improvement in water management, such as reorganization of farm drainage systems, construction of

1/ U. S. Department of Agriculture, Agricultural Adjustment Administration California State Office, Annual Report of A.A.A. (or P.M.A.) Farm Programs, Berkeley, 1939-1952. Colusa County Agricultural Commissioner, Annual Crop Statistics Reports of Colusa County, 1945-1954.

irrigation structures, as well as improved drainage, has been carried out. Part of the cost of establishing or improving permanent pasture and eradication and control of perennial noxious weeds has also been borne by the Federal program. Improvement in land levelling has been one of the major developments under this program.

THE ORGANIZATION OF THE FARM BUSINESSES THAT HAVE BEEN DEVELOPED FOR THE PRODUCTION OF RICE REFLECTS THE ADAPTATIONS OF SACRAMENTO VALLEY CONDITIONS TO THE PECULIAR REQUIREMENTS OF RICE CULTURE

Cropping systems on farms growing rice have been influenced by all of the determinants discussed above - soils, climate, biological problems, economic conditions and government programs. On specific farms, the crops grown range from rice, only, to definite rotations of rice and other crops, or combinations of rice and other crops on the same farm but not on the same fields.

In Colusa County, selected for study because conditions were typical of most rice growing areas of the Sacramento Valley, farms that grew rice in 1950 can be readily classified into those growing rice only, those growing rice and grain only, and those growing rice plus grain and other crops as usual practice. The acreage of total farmland and total cropland and the percentage distribution among the crops grown in 1950 on 49 sample farms selected from Colusa County are shown in Table 8.

Of these 49 farms, 9 or about 20 per cent produced no crop other than rice and a least 2 more would have been in this class except for diversion to comply with acreage allotments. Twenty-one, or approximately 43 per cent of the farms, produced rice and one or more of the other small grains with barley predominating. Fourteen, or 29 percent, produced rice and other grains plus some other crop, usually alfalfa or ladino clover. Three farms, or approximately 6 per cent, produced rice and alfalfa or ladino clover but no other grains.

Other crops included pasture crops other than ladino clover, oats and vetch, barley and vetch, milo and sundan grass for seed.

Land use and acres of rice.--Those farms with less than 80 acres of rice tended to devote a greater percentage of total cropland to perennial legumes than farms with larger acreages of rice. As shown in Table 8, 60 per cent of the smaller rice farms had significant acreages of alfalfa and/or ladino clover. By comparison only 40 per cent of the farms with rice acreage

Table 8

Acreage and Land Use on 49 Colusa County Farms in 1950

| Total farmland | Total cropland | Use of Total Cropland: Rice | Wheat | Barley | Alfalfa | Ladino clover | Idle or fallow | Other crops |
|---|---|---|---|---|---|---|---|---|
| Acres | | | | | Percent | | | |
| Farms with 30 to 80 acres of rice | | | | | | | | |
| 180 | 152 | 20 | | 3 | 13 | 51 | | 13 |
| 260 | 182 | 16 | | | 31 | 42 | | 10 |
| 73 | 69 | 56 | | 19 | | 25 | | |
| 200 | 200 | 20 | | | 40 | | 40 | |
| 48 | 46 | 100 | | | | | | |
| 333 | 233 | 21 | | 79 | | | | |
| 160 | 141 | 42 | | 15 | 25 | 5 | 13 | |
| 75 | 63 | 100 | | | | | | |
| 80 | 80 | 100 | | | | | | |
| 312 | 280 | 29 | | | | 32 | 39 | |
| Farms with 113 to 165 acres of rice | | | | | | | | |
| 145 | 137 | 83 | 6 | | | | | 11 |
| - | 938 | 13 | | 17 | 15 | | 34 | 20 |
| 234 | 185 | 68 | | | | 14 | 18 | |
| 320 | 296 | 44 | | 20 | | | 35 | |
| - | 3,220 | 4 | | 90 | | | 6 | |
| 160 | 145 | 100 | | | | | | |
| 156 | 156 | 100 | | | | | | |
| 600 | 575 | 28 | | 24 | 21 | | 9 | 18 |
| 220 | 202 | 82 | 10 | 8 | | | | |
| 500 | 470 | 35 | | | | 44 | | 21 |
| Farms with 200 to 324 acres of rice | | | | | | | | |
| - | 1,275 | 16 | | 48 | 16 | | 20 | |
| 320 | 304 | 70 | | 30 | | | | |
| 640 | 610 | 36 | | | | | | 64 |
| 320 | 304 | 76 | | | | | 24 | |
| 561 | 493 | 50 | | 50 | | | | |
| 763 | 680 | 37 | 2 | 61 | | | | |
| 1,280 | 1,220 | 21 | | 47 | 21 | | 11 | |
| 636 | 607 | 43 | | 33 | | | 24 | |
| 1,229 | 1,151 | 23 | 10 | 35 | | 11 | 22 | |
| 282 | 263 | 100 | | | | | | |
| 516 | 498 | 56 | | 10 | | | 29 | |
| 1,045 | 943 | 29 | 4 | 8 | | | 49 | 9 |
| 325 | 319 | 87 | | | | | | 13 |
| 1,037 | 792 | 37 | | 33 | | | 31 | |
| 1,235 | 1,105 | 27 | | 24 | | | 8 | 41 |
| 394 | 377 | 80 | | 20 | | | | |
| 2,305 | 2,286 | 14 | 7 | 65 | | 5 | 2 | 9 |
| 422 | 402 | 77 | | | | | 23 | |
| 1,700 | 1,680 | 19 | 5 | 42 | | | 34 | |

--continued--

Table 8 - continued.

| Total farmland | Total cropland | Use of Total Cropland | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Rice | Wheat | Barley | Alfalfa | Ladine clover | Idle or fallow | Other crops |
| Acres | | | | | Percent | | | |
| Farms with 348 to 625 acres of rice | | | | | | | | |
| - | 428 | 81 | | | | | | 19 |
| 1,100 | 933 | 39 | 6 | 26 | 13 | | | 15 |
| 1,700 | 1,600 | 23 | | 50 | 2 | | 19 | 6 |
| 1,730 | 1,669 | 25 | | 42 | | | 33 | |
| - | 566 | 73 | 27 | | | | | |
| 1,600 | 1,550 | 29 | 6 | 55 | | | 10 | |
| 450 | 450 | 100 | | | | | | |
| 640 | 630 | 72 | | | 2 | 3 | 23 | |
| - | 1,079 | 48 | | 52 | | | | |
| 2,185 | 2,185 | 29 | | 51 | | | 15 | |

Source: Computed from data obtained in interviews with farmers.

falling between 113-165 or 348-625 acres, devoted acreage to those legume crops. The lowest incidence of clover and alfalfa - 21 per cent of the farms - was found on the farms with between 200 and 324 acres of rice.

This allocation of land to crops other than annual grains was due largely to the type of soils found on the farms. Farms with no perennial legumes were generally those that lay in the trough with no well drained soil. The smaller and larger rice farms that had more land devoted to these legumes were so situated that they had deep well drained as well as basin soils. On some farms, ladino clover and rice had been grown on the same fields but generally they were on separate fields with different soil characteristics.

Cropping history by fields.--The range of crops sometimes grown on the fields used for rice is illustrated in Table 9. In Colusa County, 50 per cent of the fields growing rice in 1950 had been used for no crop other than rice during the period 1947-1950. Some of these were on farms that grew no crop other than rice. In other cases, these fields were used exclusively for rice, either continuously or with fallow years, and other fields on the same farm were used for other crops but never for rice.

Barley was the most common alternative crop grown on rice fields. Barley and/or wheat had been grown on 39 per cent of Colusa County rice fields during the preceding three years. The only definite cropping systems combining rice with other crops in Colusa County involved only cereals. The most common was rice-rice-fallow-barley.

These same cropping patterns were found on farms in other counties. In Sutter County fewer rice fields were being used for production of rice only. Wheat instead of barley was the principal alternative among the other cereals. The most significant difference between Sutter County and other areas was the rotation of rice-wheat and beans found on 21 per cent of the Sutter County fields surveyed. Sutter County rice growers made less use of the perennial legumes - alfalfa and clover - but relatively greater use of annual legumes - beans, peas and vetch.

TABLE 9

Cropping History From 1947-1950 For Fields on Sample Farms That Grew Rice in 1950

| | Colusa County percent of fields | Sutter County percent of fields |
|---|---|---|
| No crop other than rice | 50 | 28 |
| Rice and barley | 22 | 7 |
| Rice and wheat | 8 | 14 |
| Rice and pasture | 6 | 4 |
| Rice, wheat and beans | 5 | 21 |
| Rice wheat and barley | 2 | 0 |
| Rice and clover | 2 | 0 |
| Rice and peas | 1 | 0 |
| Rice, pasture and barley | 1 | 0 |
| Rice and beans | 1 | 0 |
| Rice and alfalfa | 1 | 0 |
| Rice, barley and milo | 1 | 0 |
| Rice, beans and barley | 0 | 4 |
| Rice, oats and vetch | 0 | 4 |
| Rice and peas | 0 | 4 |
| Incomplete data | 0 | 14 |
| | 100 | 100 |

Source: Data obtained from interviews with farmers.

In Spite of the Use of One Variety on Most of the Acreage, Large Areas of Single Soil Types, and a Small Number of Alternative Crops, the Average Yield Per Acre on Different Rice Fields in the Sacramento Valley Shows a Wide Variation.1/

Yields in Colusa County.--On 79 fields producing rice in 1950 on 40 survey farms in Colusa County, average yields range from 1,635 to 7,315 pounds of dry paddy rice per acre planted.

Cropping sequence, amount of fertilizer used, the timing of operations, and characteristics of the soil were the most important items affecting yields. Heavy applications of commercial fertilizer were associated with favorable yields on fields that had been used for rice every year for four or more years including the 1950 crop. Applications of from 49 to 84 pounds of N per acre, with an average of 60 pounds, were used to produce from 2,531 to 4,916 pounds per planted acre with an average of 3,896 pounds.

Yields in Sutter County.--Rice growers in the Sutter basin of Sutter County relied on rotations including beans or vetches, or the use of green manure crops, rather than commercial fertilizer. Thus they obtained yields of 3,500 to 6,800 pounds without the use of commercial nitrogen fertilizers.

In Sutter County, fields are classified according to location in the Sutter Basin where the rotations normally include rice-beans-and wheat, and location elsewhere in the county, where the cropping systems are more like those in Colusa County. In the eastern portion of Sutter County rice fields are summer fallowed or used for oats and vetch for one or more years between rice crops. (Appendix Table 2).

Although rice yields per acre in Sutter County average higher than in Colusa county for years when rice is grown, the highest yields reported were on fields that were not used for more than one rice crop in four years. Over a

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1/ Data on soil type, size of field, cropping history, fertilization, and yield in 1950, for survey farms in two major rice growing counties, Colusa and Sutter, are presented in appendix Tables 1 and 2.

period of four years fields in Colusa County would produce from 2 to 4 crops. Thus their aggregate production would exceed that of the similar areas in Sutter County even though annual yields are smaller in Colusa.

The highest yields reported for Sutter County were on fields where a green manure crop of vetch, beans, or peas was plowed under prior to a rice crop.

Significant Changes in Land Use on Rice Farms Have Been Made Since 1950

Between 1950 and 1955, safflower has been added to the list of alternative crops. When grown in a rice rotation it has been used instead of barley, wheat, or fallow. A more important change has been the more continuous use of land for rice. Barley has been dropped from rice-rice-fallow-barley systems on many farms and on others rice has been grown every year with no break, even for fallow, between rice crops.

The percentage of total cropland devoted to principal crops in Colusa County during the period 1947-1949 and the years 1953 and 1954 are shown in Table 10. Rice acreage increased steadily after the allotment year 1950 until it covered 29.3 percent of cropland in the county in 1954. This increase represented 12.4 percent of the total cropland, as shown in Table 11. Increased barley acreage during 1954 reflected good weather conditions and increased plantings in nonirrigated sections of the county.

In all Sacramento Valley Counties where rice is produced the percentage of total cropland planted to rice increased significantly between 1947-1949 and 1954 (Table 11). Rice, however, was the only major crop to show a significant increase in acreage during the period in all counties. Wheat showed a universal decrease, due to acreage allotments. Rice acreage also declined in 1955, of course, after the imposition of allotments.

**TABLE 10**

Perdentage of Total Colusa County Cropland in Principal Crops, 1947-1954

| | Average 1947-1949 | 1950 | 1953 | 1954 |
|---|---|---|---|---|
| | per cent | | | |
| Rice | 16.9 | 14.8 | 25.5 | 29.3 |
| Barley | 24.1 | 23.7 | 17.2 | 29.8 |
| Safflower | 0.0 | 0.0 | 3.3 | 3.1 |
| Wheat | 3.3 | 3.7 | 0.9 | 2.2 |
| Idle and fallow | 43.8 | 44.0 | 42.0 | 25.2 |

Source: Computed from Annual Crop Statistics Reports of Colusa County, Colusa, California, mimeographed report of County Agricultural Commissioner, 1947-1954.

**TABLE 11**

Changes from the 1947-1949 Averages to 1954 in Percent of Total Cropland Devoted to Rice and Principal Alternative Crops in Six Counties

| County | Change in % of cropland devoted to | | | |
|---|---|---|---|---|
| | Rice | Barley | Safflower | Wheat |
| Colusa | +12.4 | +5.7 | +3.1 | -1.1 |
| Butte | +16.4 | +4.2 | +0.2 | -4.4 |
| Glenn | + 5.8 | -8.8 | +1.8 | -1.0 |
| Sacramento | + 3.6 | -2.4 | +0.1 | -0.9 |
| Sutter | +10.2 | +1.2 | +1.0 | -0.1 |
| Yolo | + 5.2 | +3.0 | +1.3 | -1.6 |
| Yuba | +13.3 | -1.7 | +0.1 | -4.5 |

Source: Computed from Annual Agricultural Crop Reports published annually by Agricultural Commissioners of the respective counties.

## Livestock Enterprises Have Not Been Common on Sacramento Valley Rice Farms

In 1950, only 18 percent of the survey farms in Colusa County included owned livestock, while another 22 percent rented pasture to livestock men. As shown in Table 12, more of the smaller rice growers tended to have livestock. This followed from the greater tendency to produce forage crops on these than on the larger farms. The group with the predominantly heavy soils and little production of other than cereal crops, made the least use of livestock to market their crops. Livestock were found on 21 percent of these farms compared with 70 percent on the group of farms with 30-80 acres of rice. There was a greater tendency to rent out pasture on the larger rice farms because of the greater acreage of fall sown grain crops.

The relatively small number of rice growing farmers owning livestock indicates a lack of experience in handling stock on these farms. Under conditions in 1950, there was no established demand for greater forage production. After 1950, the increased production of cereal grains at the expense of decreased legume production did not encourage increased livestock ownership.

TABLE 12

Percent of Colusa County Rice Farmers Owning Livestock or Renting Pasture, 1950

| Rice Acreage | Percent of farms owning livestock | Percent of farms renting pasture |
|---|---|---|
| acres | % | % |
| 30-80 | 40 | 30 |
| 113-165 | 20 | 20 |
| 200-324 | 5 | 16 |
| 348-625 | 10 | 30 |

Source: Compiled from data obtained in farmer interviews.

Acres of Rice Per Farm Proved to be One of the Most Important Determinants of Farm Organization on the Farm Studied.

With few exceptions, rice was the principal cash crop on all farms where it was grown. On those farms with rice and grain combinations, the other grains used the same labor and machinery resources used by the rice. Income from these other enterprises was considered supplemental to that from the rice enterprise.

Data on rice acreage on individual farms in 1950 indicated definite concentrations of farms within certain ranges of rice acreages. Table 13, giving the distribution of rice acreages on 691 farms, shows such concentrations in the following classes.1/

| Acres | Farms |
|---|---|
| 40-79 | 90 |
| 120-159 | 96 |
| 200-320 | 147 |
| 360-640 | 100 |

The sample of farms chosen for study was stratified to obtain data for typical farms in these four groups.2/ Significant differences between the organization of farms in these groups will serve as the basis for development of at least one typical farm organization for each group in later sections.

Ten farms with more than 640 acres in rice were visited to obtain information on characteristics of these larger businesses. They were found to be so dissimila that no attempt will be made in this publication to analyze them. No one description could be called "typical" of this group, as can be done for the smaller farms.

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1/ The average ranges of these class groupings are widened to account for the effects of acreage allotments in 1950. Since rice growers had different percentage reductions in acreage because of differences in the timing of their increases in the base period, growers with similar capacity for production were spread over a wider range in acreage.

2/ Data in Table 8, pages 31 and 32, are grouped according to this stratification.

TABLE 13

Acres of Rice Per Farm for 681 Farms in the Five Principal Rice Growing Counties, 1950

| Group number | Acres of rice in 1950 | Number of farms a/ |
|---|---|---|
| | 14-39 | 50 |
| I | 40-79 | 90 |
| | 80-119 | 76 |
| II | 120-159 | 96 |
| | 160-199 | 41 |
| III | 200-239 | 53 |
| | 240-279 | 47 |
| | 280-319 | 47 |
| | 320-359 | 19 |
| IV | 360-399 | 19 |
| | 400-439 | 23 |
| | 440-479 | 14 |
| | 480-519 | 14 |
| | 520-559 | 11 |
| | 560-599 | 13 |
| | 600-639 | 6 |
| | 640-679 | 10 |
| | 680-719 | 7 |
| | 720-759 | 5 |
| | 760-799 | 6 |
| | 800+ | 34 |
| | | 681 |

a/ Farm as used here means the total farming operations of a farm operator or operating partnership.

Source: Compiled from unpublished data obtained from county Agricultural Stabilization and Conservation Committee offices, Production and Marketing Administration, in Butte, Colusa, Glenn, Sutter, and Yolo Counties.

## THE DETAILS OF ORGANIZATION AND OPERATION DIFFER FOR RICE FARMS THAT ARE TYPICAL OF DIFFERENT ACREAGE GROUPS

The organizations typical for farmers with different acreages of cropland and rice will be examined in detail in this report. The manner in which the principal alternative, barley, fits into these farm businesses will be included, but consideration of other alternatives will be reserved for a later report.

Acreage and machinery.--Although acreage of cropland on the Colusa County farms studied ranged from 46 to 3,220[1] acres of rice per farm tended to concentrate within certain ranges.[2] Study of the cropping systems and the inventories of equipment on these farms indicates a close relationship between the acreage of rice and the size of tractor and inventory of related equipment. Farm organizations built around the important size groups and inventories of equipment most likely to be found on farms with these acreages will be synthesized and used to demonstrate required inputs.

Rather than use average horse power and average sizes of equipment that might not exist, analysis in this report will be based on inventories of the actual manufactured sizes of equipment found on the different farms.

Budgets and supporting data will be presented for farms with 150, 300, 450, and 600 acres of rice.

### The Organization of a Farm With 300 Acres of Rice Can be Taken as Typical of Farms in an Important Size Group

Farmland and cropland.--The organization costs and returns for a common size of business built around an annual production on 300 acres of rice will be developed in detail.

Assuming a cropping sequence of rice-rice-summer fallow-rice, this farm in order to have 300 acres of rice, would have a total of 450 acres of cropland. The typical farm of this type would have in addition to the 300 acres of land

1/ Table 8, pages 31 and 32.

2/ Table 13, page 40.

actually in rice some waste land including land not yet drained for farming, land in road or canal right of ways, etc.

Farms visited had as much as one third of their total farmland in these noncropland uses. To allow for the costs of owning some noncropland, the budgets developed below will be based on a total acreage equal to cropland plus ten per cent of cropland. For example, a farm averaging 300 acres of rice will have that acreage plus 150 acres in summer fallow and 45 acres of land not being farmed.

A typical inventory of equipment.--A typical inventory of equipment for a fully equipped farm operating 300 acres of rice on 450 acres of cropland is shown in Table 14. The most important items of equipment in this inventory are the tractors and the harvesters.

The inventory is built around a 65-drawbar-horsepower tracklaying tractor (T-7) assumed to have been purchased new and to have a life of 15 years. In addition there is the smaller, older tractor that is used for odd jobs. Transportation is provided by two $1\frac{1}{2}$-2 ton trucks and one $\frac{1}{2}$-ton pickup. The plows, discs, floats, harrow, chisel, and landplane are similar to the items that might be found on any irrigated crop farm. A checker and ditcher are added to take care of the task of building and repairing rice levees.

TABLE 14

Equipment Inventory, Estimated Life, and Average Investment for a Farm Fully Equipped to Produce 300 Acres of Rice

| Item | Size | Year New a/ | Year Acquired b/ | Estimated Years of Life | Price Paid c/ | Salvage Value d/ | Annual Fixed Deprec. e/ | Average Value f/ |
|---|---|---|---|---|---|---|---|---|
| Tractor (track) | 65 h.p. (T7) | 1948 | 1949 | 15 | 7,000 | 700 | 420 | 3,850 |
| Tractor (track) | 30 h.p. (T3) | 1930 | 1940 | 10 | 1,000 | 100 | --- | 100 g/ |
| Truck | 1 1/2 ton | 1951 | 1951 | 5 | 3,000 | 1,000 | 400 | 2,000 |
| Truck | 1 1/2 ton | 1953 | 1953 | 5 | 3,000 | 1,000 | 400 | 2,000 |
| Pick-up | 1/2 ton | 1952 | 1952 | 3 | 1,800 | 600 | 400 | 1,200 |
| Plows | 10/14" | 1949 | 1949 | 8 | 1,350 | 135 | 152 | 743 |
| | 4/14" | 1940 | 1940 | 8 | 350 | 35 | | 35 |
| Disk | 20' | 1947 | 1947 | 10 | 1,600 | 160 | 144 | 880 |
| Float | 12' x 30' | 1946 | 1946 | 15 | 125 | 25 | 7 | 75 |
| Diker | -- | 1947 | 1947 | 15 | 900 | 90 | 54 | 495 |
| Harrow | 20' | 1947 | 1947 | 15 | 140 | 14 | 8 | 77 |
| Chisel | 10' | 1949 | 1949 | 8 | 750 | 75 | 84 | 413 |
| Ditcher | 6-7' | 1944 | 1944 | 15 | 125 | 12 | 8 | 68 |
| Landplane | 12' x 60' | 1946 | 1946 | 15 | 1,850 | 200 | 110 | 1,025 |
| Dozer | 6' | ---- | 1940 | 15 | 500 | 50 | 30 | 275 |
| Bank-out Wagon | 120 sack | 1948 | 1948 | 8 | 1,300 | 200 | 138 | 750 |
| Sm. S.P. Harvester | 12' | 1948 | 1948 | 8 | 7,000 | 700 | 788 | 3,850 |
| Sm. S.P. Harvester | 12' | 1948 | 1948 | 8 | 7,000 | 700 | 788 | 3,850 |
| Machinery Carry-all | -- | 1945 | 1945 | 15 | 525 | 52 | 32 | 288 |
| Grease Wagon | -- | 1953 | 1953 | 10 | 500 | 50 | 455 | 275 |
| Farm Shop Equip. | -- | ---- | ---- | -- | 2,000 | | 200 | 2,000 h/ |
| Total | | | | | | | 4,208 | 24,249 |

Table 14 --continued--

Table 14 --continued.

a/ Year new is based on the most frequent year new for these items appearing on the inventories of farms of this size for which records were obtained. These data were obtained in 1951 and 1952 and rechecked in 1953 with a smaller sample of operators. They would reflect the changes that occurred in equipment purchase through 1954, the last year before acreage allotments were reimposed.

b/ Because of the great variations in conditions and price of items purchased from previous users, only the smaller tractor and dozer are listed here as used equipment. These items were typically old equipment on this size of farm. With other items, the policy varied from purchase of all new to all used equipment.

c/ This is the most frequent price paid for each item in the "year acquired" listed. These prices, therefore, include typical extras, such as wide tracks on tractors.

d/ Estimated at 10% of new price. During the period of this study salvage values were sharply higher because of the inflation that occurred in the price of new items after the original date of purchase.

e/ Computed on a straight line basis. New price less salvage value divided by years of life.

f/ Average value over the life of the investment. $1/2\left[(\text{new price-salvage value}) + \text{salvage value}\right]$

g/ For items that are in use beyond the estimated years of life from time of purchase, the salvage value is included as the average investment.

h/ It is assumed that an annual expenditure of $200 will maintain the average value of the shop equipment.

Source: Compiled from records obtained in farm interviews.

The two self-propelled harvesters are stock model manufactured machines that have been modified to stand the rigors of rice harvest. They use a smaller header than would be the case for other small grain. In addition they have been placed on tracks rather than rubber tires and will have equipment for bulk handling of rice. These machines represent one-fourth or more of the total investment in machinery and have a shorter expected life than the tractors.

The bankout wagon, on tracks and with a bulk bed, will carry the rice from the harvesters to the trucks which must wait on roads or dry ground. For service, a rice farm of this type would have a grease wagon normally constructed in the home shop for servicing the tractor and equipment. A figure of $2,000 has been added for farm shop equipment. Some machinery repair and some construction is normally done by rice growers in their own shops.[1/]

Value of equipment.--The inventory shown here would have an average value over the life of the equipment of $24,249. This is based on the life and new cost of equipment found on rice farms between 1950 and 1953. In very few cases one would find a rice farm on which all the equipment had been purchased in a single year or even over a two or three year period. In these cases where inventories are built up over a very short period some of the equipment would be purchased new and some would be purchased used from other rice growers. If the inventory of equipment shown in Table 14 had been purchased new at prices that prevailed in the rice growing area in 1954 the total investment required would have been $49,500.

The manner and extent to which rice growers have lowered their necessary investment in equipment by use of old machines, either repaired or purchased from other growers, will be examined in detail in a later report in this series.

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1/ Those farms that customarily build major items of machinery may have $10,000 to $15,000 invested in shop equipment.

## Equipment Requirements for Farms with 150, 300, 450, and 600 Acres of Rice Differ Significantly

Inventories of equipment typical of those found on well-equipped rice farms of different acreages are shown in Table 15.

150 acres of rice.--Farms producing 150 acres of rice, column 1, would have much less owned equipment than the 300-acre unit previously discussed. The major source of power would be a 45 horsepower tractor, no trucks except a pickup would be owned. The plow, disc, flot, and harrow would be part of the owned inventory; chisel, landplane, and checker would not be owned because it would not be feasible to pull them with this smaller tractor, or to make the investment for an operation including only this acreage of rice. A smaller ditcher and scraper would replace the checker and the dozer blades. Only one harvester would be owned, and the farmer would probably own his own bankout wagon although it is possible that this service would be hired. Those items of equipment not available in the owned inventory would be hired from other farmers, or custom operators would be hired to come in with larger tractors and perform the services.

300 acres of rice.--A grower might attempt to operate acreages of rice up to 300 acres with a tractor no larger than the 45-drawbar horsepower found typical for smaller acreages. If so, he would make greater use of a second tractor. Other than these items, his inventory, column 2, Table 15, would be much like that found on a farm operating 300 acres with a T-7 tractor, (column 4, Table 15). The plow, disc, and float would be smaller than those purchased for use with a 65 horsepower tractor. The harvest equipment would be the same as on the other inventory. The farm with this inventory built around the 45 horsepower tractor would have an upper limit of approximately 300 acres of rice or less that could be operated successfully. With the 65 horsepower tractor, on the other hand, the upper limit for this inventory of equipment could be as much as 450 acres.

450 acres of rice.--To expand from 300 acres to 450 acres with a 65 horsepower tractor would require very few additions to the inventory, if any (column 4, Table 15). A most probable one would be the addition of another bankout wagon, particularly, if the added acreage meant that larger fields were being operated and, therefore, greater distances would be traversed to reach the edge of the field.

600 acres of rice.--When acreage is expanded beyond 450 acres, one 65 horsepower tractor provides insufficient power, and other items of equipment are also inadequate. The inventory shown in Table 15, column 5, uses both a 65-and a 45-drawbar horsepower tractor as well as the smaller one for odd jobs. A third truck has been added as well as the necessary tillage equipment, plow, disc, etc., to be used by the second major tractor. A third combine is added, in this case a pull combine rather than a self-propelled machine, since added tractors are available for harvest. With the third combine a third bankout wagon is added. This farm, like the 300- and 450-acre units, has a machinery carry-all for moving equipment from field to field or along the roads.

The average value of the inventories of equipment from Table 15 are estimated to be as follows:

| Acreage of rice | Average value equipment inventory |
|---|---|
| 150 | $ 10,888 |
| 300 | 20,437 |
| 300 | 24,249 |
| 450 | 24,997 |
| 600 | 36,287 |

In all cases these average values represent the total for the inventory that is obtained by adding together the estimated salvage value for every item of equipment plus one-half of the value of every item minus its salvage value.

TABLE 15

Typical Inventories of Equipment for Farms Operating 150, 300, 450, and 600 Acres of Rice Per Year

| Item | Size | Acres of Rice | | | | |
|---|---|---|---|---|---|---|
| | | 150 | 300 a/ | 300 | 450 | 600 |
| | | dollars b/ | | | | |
| | | 1 | 2 | 3 | 4 | 5 |
| Tractor (track) | 65 DBH(T7) | | | 3,850 | 3,850 | 3,850 |
| " " | 45 DBH(T5) | 2,640 | 2,640 | | | 2,640 |
| " " | 30 DBH(T3) | | 100 | 100 | 100 | 100 |
| Truck | 1½ T | | 2,000 | 2,000 | 2,000 | 2,000 |
| " | 1½ T | | 2,000 | 2,000 | 2,000 | 2,000 |
| " | 1½ T | | | | | 2,000 |
| Pickup | ½ T | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 |
| " | ½ T | | | | | 1,200 |
| Plow | 10/14" | | | 742 | 742 | 742 |
| " | 5/14" | 330 | 330 | | | 330 |
| " | 4/14" | | 35 | 35 | 35 | 35 |
| Disk | 20' | | | 880 | 880 | 880 |
| " | 12' | 385 | 385 | | | 385 |
| " | 7½' | | 39 | | | |
| Float | 12' x 30' | 75 | 75 | 75 | 75 | 75 |
| " | 12' x 30' | | | | | 75 |
| Harrow | 20' | 77 | 77 | 77 | 77 | 77 |
| Chisel | 10' | | | 412 | 412 | 412 |
| Landplane | 12' x 60' | | | 1,025 | 1,025 | 1,025 |
| " | 10' x 60' | | 198 | | | |
| Ditcher | 6-7' | 69 | 69 | 69 | 69 | 69 |
| Checker | | | | 495 | 495 | 495 |
| Dozer | | | | | | 108 |
| " | 6' | | 275 | 275 | 275 | |
| Tumble Bug Scraper | 7-8' | 237 | | | | |
| Sm. S.P. Harvester | 12' | 3,850 | 3,850 | 3,850 | 3,850 | 3,850 |
| Sm. S.P. Harvester | 12' | | 3,850 | 3,850 | 3,850 | 3,850 |
| Pull Combine | 14' | | | | | 3,300 |
| Bankout Wagon | 120 sack | 750 | 750 | 750 | 750 | 750 |
| " " | 120 sack | | | | 750 | 750 |
| " " | 120 sack | | | | | 750 |
| Machinery Carry-all | | | 289 | 289 | 298 | 289 |
| Grease Wagon | | 275 | 275 | 275 | 275 | 275 |
| " " 2 | | | | | | 275 |
| Farm Shop Equipment | | 1,000 | 2,000 | 2,000 | 2,000 | 2,500 |
| Total | | 10,888 | 20,437 | 24,249 | 24,997 | 36,287 |

a/ Farms with the smaller track-tractor would have an upper limit of approximately 300 acres. Those with the larger size might operate up to 450 acres with only minor additions of equipment.

b/ Average investment

Source: Compiled from records obtained by interviews with rice growers.

## Details of Inputs Required in Rice Production Can Be Described Best by Using Calendars of Operations

The calendar of the operations performed on a farm with 300 acres of rice appears in Table 16. The total farm cropland includes 150 acres of first-year rice, 150 acres of second-year rice, and 150 acres being summer fallowed for production of rice in the following year. This calendar shows in detail the input of labor, power, and equipment used in performing the different operations, and the time at which these operations are likely to be performed. Data for this calendar were developed from the results of interviews with rice growers. Detailed accounts are taken of the chronological order of the practices followed, and the acres per day covered by equipment used. From analysis of the interview schedules, typical operations and inputs were established. Tractors and other equipment shown under "power" and "machinery size" correspond to those listed in the inventory given in Table 14. This calendar and others in later sections, therefore, represent standards of typical inputs for the size of farms chosen. Although data on inputs and income are also to be given for farms with 150, 450, and 600 acres of rice, the farm with 300 acres will be presented in greater detail for purposes of explanation.

On a farm of this size the operator will attempt to perform as much of the labor as possible. The operations to be performed on each 150-acre field and the size of equipment from the inventory discussed above, together with the acres that can be performed in a 10-hour day, establish the power and man-labor requirements for performing the practices.

Ten-day time periods are used in planning the work. The "days available" within these time periods depends upon the weather and whether work is done on Sundays and holidays. During critical seasons, such as the spring work season and the harvest season, operators typically consider that every day with favorable weather is a work day.

TABLE 16

Calendar of Operations, 300 Acres Rice and 150 Acres Summer Fallow: 150 Acres First Year, 150 Acres Second Year Rice (Tractors include a T-7 and a T-3 for bulldozer operation) a/

| Month and period | Field | Operation | Crew | | Equipment size | Acres per 10 hr. day | Requirements | | Days available | Labor required | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Man | Power | | | Power | Man | | Operator | Hired | |
| | | | | | | Acres | Hours | | Days | Hours | | Hours |
| March 11-20 | 1 | Plowing | 1 | T-7 | 10/14" | 20 | 75 | 75 | 7 | 70 | -- | 70 |
| 21-31 | 1 | Plowing | | | | | | | 7 | 5 | -- | 5 |
| | 2 | Disking | 1 | T-7 | 20' | 37.5 | 40 | 40 | | 40 | -- | 40 |
| | | Floating | 1 | T-7 | 12' x 30' | 45 | 33 | 33 | | 25 | -- | 25 |
| April 1-10 | | Floating | | | | | | | 7 | 8 | | 8 |
| | 1 | Survey | -- | Custom | | | | | | | | |
| | 2 | Plowing | 1 | T-7 | 10/14" | 16 | 94 | 94 | | 62 | -- | 62 |
| 11-20 | | Plowing | | | | | | | 7 | 32 | -- | 32 |
| | 1 | Plow contours | 1 | T-3 | 4/14" | 150 | 10 | 10 | | 10 | -- | 10 |
| | 2 | Float | 1 | T-7 | 12/30' | 45 | 33 | 33 | | 28 | -- | 28 |
| 21-30 | | Float | | | | | | | 10 | 5 | -- | 5 |
| | 1 | Plow checks | 1 | T-7 | 10/14" | 100 | 15 | 15 | | 15 | -- | 15 |
| | 1 | Checking | 2 | T-7 | Checker | 150 | 20 | 20 | | 10 | 10 | 20 |
| | 1 | Plow borrow pits | 1 | T-7 | 10/14" | 150 | 10 | 10 | | -- | 10 | 10 |
| | 1 | Disk--Harrow | 1 | T-7 | 20'--Harrow | 37.5 | 40 | 40 | | 40 | -- | 40 |
| | 2 | Disk--Harrow | 1 | T-7 | 20'--Harrow | 37.5 | 40 | 40 | | | 40 | 40 |
| | 2 | Repair checks | 1 | T-7 | Ditcher | 150 | 10 | 10 | | | 10 | 10 |
| | 1 | Placing boxes | 2 | T-3 | Dozer | 200 | 7.5 | 15 | | 7.5 | 7.5 | 15 |
| | 1 | Closing checks | 1 | T-3 | Dozer | 150 | 10 | 10 | | -- | 10 | 10 |
| | 2 | Closing checks | 1 | T-3 | Dozer | 150 | 10 | 10 | | -- | 10 | 10 |
| | 1&2 | Fertilizer | 1 | -- | Truck | 120 | 25 | 25 | | -- | 25 | 25 |
| | | Fertilizing | | Plane-Custom | | | | | | | | |

Table 16 --continued--

Table 16 - Continued.

| Month and period | Field | Operation | Crew Man | Crew Power | Equipment size | Acres per 10 hr. day | Requirements Power | Requirements Man | Days available | Labor required Operator | Labor required Hired | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Acres | Hours | | Days | Hours | | Hours |
| May 1-10 | | Flooding | 2 | ... | | | | 150 | 10 | 50 | 100 | 150 |
| | | Seeding | 1 | ... | | | | 30 | | 30 | ... | 30 |
| | | Seeding | Plane-custom | | | | | | | | | |
| 11-31 | | Irrigating | | | | | | | 21 | 210 | ... | 210 |
| June 1-30 | 3 | Knock checks | 1 | T-7 | Plow 10/14" | 60 | 25 | 25 | | 25 | ... | 25 |
| | 3 | Floating Plowing | 1 | T-7 | 10/14" | 20 | 75 | 75 | | 75 | ... | 75 |
| | | Irrigating | | | | | | | 30 | 120 | ... | 120 |
| July 1-31 | | Irrigating | | | | | | | 31 | 124 | ... | 124 |
| | 3 | Disking | 1 | T-7 | 20' disk | 45 | 33 | 33 | | 33 | ... | 33 |
| | 3 | Land planing | 1 | T-7 | 12' L. Plane | 20 | 75 | 75 | | 75 | ... | 75 |
| | 3 | Chiseling | 1 | T-7 | 10' Chisel | 22.5 | 67 | 67 | | 67 | ... | 67 |
| August 1-31 | | Irrigating | | | | | | | 31 | 124 | ... | 124 |
| Sept. 1-30 | 1-2 | Drain | 1 | ... | | | | 20 | 26 | 20 | ... | 20 |
| | 1-2 | Open checks | 1 | T-3 | Dozer | | 10 | 10 | | 10 | ... | 10 |
| Oct. 1-14 | 1-2 | Harvesting | 1 | S.P. | Sm. Pusher | 11.25 | 106 | 133 | 14 | 133 | ... | 133 |
| | | | 1 | S.P. | Sm. Pusher | 11.25 | 106 | 133 | | ... | 133 | 133 |
| | | | 1 | T-7 | 1 bank out | 22.50 | 106 | 133 | | ... | 133 | 133 |
| | | | 2 | 1/2T | Trucks | 22.50 | 266 | 266 | | ... | 266 | 266 |
| | | Total | | | | | | | | 1,454 | 755 | 2,209 |

a/ The T-7 tractor ranges from 60-69 Drawbar Horsepower, averages 65 DBHP. The T-3 has 30 DBHP.

Source: Compiled from data obtained in farm interviews.

The operator's own equipment is used whenever possible. For surveying, fertilizing, and seeding, custom services are obtained.

Timing of cultural operations.--In years with the "normal" amount of rainfall in February and March, plowing of fields in preparation for seeding rice typically does not start until mid-March. In wet years and on poorly drained fields the first spring work may be delayed until April. The plowed fields are allowed to stand from 2 to 4 weeks to dry the surface soil.[1/] Other tillage practices and preparation of the fields for irrigation are completed in time to permit seeding during the first 10 days of May whenever possible. Bad weather, or not enough equipment to work a given acreage, delayed seeding as late as June 1 on some farms studied.

After completion of rice seeding, equipment and labor are used for tending irrigation and working of summer fallowed fields until time to begin harvest operations in September or October. Field work generally ends with completion of rice harvest.

Sequence of cultural operations.--Calendar of Operations, Table 16 shows the dovetailing of three different sequences on three fields - field 1 producing rice after being summer fallowed the preceding season, field 2 producing rice for the second year in succession, and field 3 being summer fallowed following two successive years of rice production.

Spring work in this calendar begins in mid-march with the plowing of the field that was fallowed the previous summer.[2/] The sequence of operations used here assumes that the field was not prepared for irrigation the preceding season.

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1/ Better aeration of the surface soil and weed control were given by farmers as reasons for this practice.

2/ If the season has been warm and wet, this first plowing may be preceded by a disking to turn down volunteer plant growth, but this is not usually required on fallowed ground - unless a former crop has been grown. Fields with stubble from a preceding crop - field 2 may be disked before plowing.

3/ Some growers build levees during the fallow year. Others delay these operations until after the field has been plowed and partly worked during the first year of rice growing. Use of either time sequence would not change the total of inputs shown on this calendar since either field 1 would be checked up for irrigation in the spring or field 3 would be checked up during the summer as part of the fallowing operations.

After plowing, it is floated or dragged to smooth it and permit easier surveying.[1]

Working First or Second Year Rice Fields.--One of the major differences between seedbed preparation on the field that was in rice the preceding year and the field that was summer fallowed lies in the fact that the farmer still has the levees that were used for water control the previous year.[2] In effect, this means that the field is divided into many smaller fields for working. The effect of this is illustrated by the difference in acres per day plowed in fields 1 and 2 in Table 16. When the field can be treated as one of 150 acres the T-7 tractor-based on records of actual plowing collected from farmers - can be expected typically to plow 20 acres per 10 hour day. The same equipment working in field 2 cut into from 5 to 15 smaller "fields" by the levees, can be expected to average only 16 acres per 10 hour day.

Preparation for irrigation.--The rice plant is grown with the roots and the lower parts of the leaves and stems continually submerged during most of its growing season. This requires that the fields must be prepared to hold the desired amount of water for a period of several months. Checking operations on a field involve preparation of the system of levees that will confine water within its borders but permit a flow from the high to the low corner of the field which will give water circulation within each check as well as maintain the desired depth of water.

Surveying the lines for the levees may be done by the farmer himself or a hired agent. The latter is more typical and is assumed here. These lines or

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1/ On soils badly infested with water grass, some growers do not float or drag in the spring. Resulting compaction tends to bring moisture to the surface and sprout grass seeds ahead of the rice. Twenty-two of the 53 fields for which complete inputs were obtained were floated or dragged in 1950. By comparison, 46 of the 53 fields were plowed in the spring, 45 were disked one or more times and 29 were harrowed.

2/ Water is held on the rice fields by levees which are usually constructed on the contour of the land. A rice field is completely enclosed by a levee of three to four feet elevation. The field is divided into compartments or "checks" varying in size according to the slope of the land. There is normally a difference of two or three-tenths of a foot in elevation between checks. Water enters the field at the highest end and passes from one check to another through boxes or gates set in the levees.

contours are marked on the ground with a light tractor and plow. "Plowing checks" means plowing two ways along the contour lines to throw up a back furrow of loose soil. "Checking" - the actual construction of the levee is done with a heavy drag that is shaped like a V. This machine drawn by two or more crawler tractors typically with 65 horsepower or more - draws in the loose soil and releases it through the narrow end of the V to leave a levee or ridge of soil that may be as high as 24 inches and as wide as 5 to 7 feet at its base. The "borrow pits" - the strips from which soil is collected for building the ridge are partly filled by making a round with a heavy tractor and plow. To close the system for holding water the ends of levees crossing and dividing the field must be joined to the levee that serves as the outside border. This is normally done with a dozer blade on a tractor or a tractor-mounted scraper. The same tool is used to cut openings in the levees to permit insertion of "boxes" used to control the flow of water from the high into the lower check.

Repairing checks.--The sequence of checking operations on a field that has been in rice the preceding year - field 2 - normally required only repairing weakened portions of levees that have already held water for one year's crop. This can normally be done with a ditcher or other machines requiring less power than the checker used for new levees.[1/]

Fertilizing.--The use of synthetic nitrogen fertilizers increased during the course of this study. In 1950, 27 of the 53 fields for which detailed inputs were analyzed received synthetic nitrogen applications. Farmers interviewed in 1952-1954 indicated an increased use of fertilizer.

Fertilizer was applied by broadcasting from an airplane or by drills or broad cast seeders on the ground. Airplane application is assumed in calendars used her

1/ Some farmers with large tractors and large fields prefer to plow down the levees as the first operation so they can plow the entire field without interference. After plowing and other operations that can be more economically done without the levees, the levees are rebuilt. In contrast, operations with tractors of 30-45 horsepower can more easily farm within the confines of the levees and may only repair, not rebuild levees between rice crops, even over periods of 5 to 10 years.

Flooding and seeding.--When seedbeds have been worked and irrigation water is available, fields are flooded as quickly as they can be covered to a depth of 12 inches or more. Seeding is done by airplanes, broadcasting seed rice into newly flooded fields. Only two of the 75 rice growers interviewed used a drill to seed rice in 1950.

Irrigating.--After seeding, water is normally held at depths up to 12 inches for periods of 18-21 days. This retards the emergence of water grass. During this period of deep water, constant vigilance is necessary to keep the levees in repair and forestall breaks - especially in windy weather. At the end of this period, fields are drained to give the rice seedlings a better start, and then the water level is raised gradually as the plants grow.[1/]

After the stand has been established, fields are patrolled periodically to assure that the proper water level is being maintained and to watch for damage to the levees by muskrats or other pests, that might cause levees to break and drain part or all of the field.

Draining and opening checks.--In late August or early September fields are drained. Checks are opened with a dozer or a shovel to permit rapid and complete drainage that will facilitate drying of soils to support harvest equipment.

Summer fallow operations.--When rice has been seeded on fields 1 and 2, summer fallow operations are started on field 3. Old levees or checks are broken down with a plow, dozer, or grader.

Operations listed here after knocking down old checks include plowing, disking, land planing, and chiseling. In some cases the disking is omitted and

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1/ Some variations of this pattern have developed in recent years. Because water weeds may outgrow rice on the drained fields, a constant level of 6 to 8 inches of water may be maintained from the time of flooding.

not all fields are chiseled. Again this list assumes that all probable operations are covered. The land planing smooths the remains of old levees and borrow pits and over a period of years accomplishes some leveling of minor irregularities. Chiseling breaks up hard pans resulting from farming operations and leaves the field rough and loose to permit drying which tends to kill the rhizomes and roots of water-loving plants.

Havesting.--In the fall, when fields are dry and moisture content of the rice kernels has dropped to 25% or below, combining is started. The inventory of equipment used here for 300 acres of rice assumes two self-propelled combines.[1/] Rice is hauled from the fields in a tractor drawn bank-out wagon, mounted on tracks or large rubber tires and, therefore, capable of traversing the fields and carrying the rice to trucks waiting on dry ground. In this calendar, the use of self-propelled combines frees the T-7 - 65 horsepower - tractor to pull the wagon. If this tractor were used for pulling a combine, another large tractor would probably be hired to perform this job.

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1/ "Small-pusher" is used to designate commercially manufactured machines offered for sale by suppliers of other farm machinery. A large "pusher" or self-propelled combine such as those made by growers or especially built for rice harvesting would represent an investment of 5 to 7 times that in these small machines but would be capable of harvesting up to 3-4 times as much grain per day in good weather and being able to operate in heavy rice or wet conditions that might stop the smaller machines.

Comparison of Calendars for Different Size of Farms Shows Similar Practices but Differ as in the Amount of Services Hired.

The practices performed on smaller and larger farms are essentially the same as those on a farm with 300 acres of rice. Calendars of operations for farmers with 150, 450 and 600 acres of rice in a rice-rice-fallow sequence are given in Tables 17, 19, and 20. In addition, Table 18 presents a calendar for a farm with 300 acres of rice, but with an alternative inventory of equipment based on a T-5 - 45 horsepower - tractor.

The similarities in practices on all of these calendars reflect this finding in analyzing rice production on the 75 farms studied. Although there were some differences in the operations on farms analyzed, they were more closely correlated with size of tractor used than with rice acreage.

150 acres of rice.--The smaller tractor used on farms averaging 150 acres of rice could not accomplish as much work per day as the T-7. In spite of this it was easier for the operator to have all of his rice seeding completed during the period May 1-10 than for the one operating 300 acres of rice. There was only one 10 day period in the spring, March 11-20, when the 7 days available were fully utilized in field operations. (Table 17). The remainder of the available time in each period was free time for other work or represented Sundays and holidays. A larger tractor would free even more time; a smaller one would cause the operator to use more of the time available. In comparison, the operator with 300 acres of rice and a T-7 tractor, Table 16, used all the days available for field work in every period from March 11 until his fields were ready for seeding. The operator on the smaller acreage had more chance of seeding his rice by the time planned, even if he experienced more bad weather or time lost in breakdowns than was allowed for in the calendar. For the larger acreage, with all available time for field work allotted, an above normal amount of bad weather or breakdown would mean a delay in seeding.

300 acres of rice with a smaller tractor.--By adding a smaller tractor with equipment - T-3, 30 horsepower - and using it in field operations with its complement of equipment, the operator can operate up to 300 acres of rice with a T-5 as his largest tractor. This situation is presented in Table 18, using the inventory of equipment from Table 15, page 50. The farm operator is required to work every available day until the rice is seeded and the water is lowered three weeks later. Hired labor is used for the second tractor and for other jobs to a much greater extent than on either the farm with 150 acres of rice or the farm with 300 acres of rice and the larger tractor.

450 acres of rice with a T-7 tractor.--An even tighter relationship exists on those farms where the T-7 tractor and the inventory of equipment suitable for 300 acres of rice is used to operate 450 acres and the accompanying 225 acres of fallow land. These operators, as illustrated in the calendar of operations, Table 19, do not attempt to "get by" by cutting out some practices but make greater use of hired labor. Unlike the 300 acres with a T-5 where the smaller T-3 was used to supplement the field work, this larger operator is more likely to perform field work at night so that both the operator and the hired man are using the larger tractor. Even under this arrangement there is little free time prior to seeding. Any delay or a slower rate of operation at night than in day time would delay seeding beyond the dates determined by the other calendars above.

600 acres of rice.--Those farms producing rice on more acres than can be handled by a T-7 tractor typically showed great increases in inventory of equipment and use of hired labor. As shown in Table 20, for 600 acres of rice, two major tractors, a T-7 and a T-5 are used. Both are used for major field work, such as plowing and in addition the calendar drawn here assumes night work in order to have the rice seeded by early May. Even this combination allows little free time prior to seeding.

TABLE 17

Calendar of Operations, 150 Acres Rice and 75 Acres Summer Fallow: 75 Acres First Year, 75 Acres Second Year Rice - (One T-5 tractor)

| Month and period | Field | Operation | Crew | | Equipment size | Acres per 10 hr. day | Requirements | | Days available | Labor required | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Man | Power | | | Power | Man | | Operator | Hired | |
| | | | | | | Acres | Hours | | Day | Hours | | Hours |
| March 11-20 | 1 | Plowing | 1 | T-5 | 5/14" | 16 | 47 | 47 | 7 | 47 | | 47 |
| | 2 | Disking | 1 | T-5 | 12' | 30 | 20 | 20 | | 20 | | 20 |
| March 21-31 | 2 | Disking | 1 | T-5 | 12' | 30 | 5 | 5 | 7 | 5 | | 5 |
| | 1 | Floating | 1 | T-5 | 12' x 30' | 30 | 25 | 25 | | 25 | | 25 |
| April 1-10 | 1 | Survey (custom) | | | | | | | | | | |
| | 2 | Plowing | 1 | T-5 | 5/14" | 14 | 54 | 54 | 7 | 54 | | 54 |
| April 11-20 | 1 | Plow contours | 1 | T-5 | 5/14" | 150 | 5 | 5 | 7 | 5 | | 5 |
| | 2 | Float | 1 | T-5 | 12' x 30' | 30 | 25 | 25 | | 25 | | 25 |
| | 1 | Plow checks | 1 | T-5 | 5/14" | 150 | 5 | 5 | | 5 | | 5 |
| | 1-2 | Harrow | 1 | T-5 | 20' | 50 | 30 | 30 | | 30 | | 30 |
| April 21-30 | 1 | Checking T-7, Driver[a] | 1 | T-5 | Checker[a] | 75 | 10 hrs. rented 10 hrs. operater | 20 | 10 | 10 | | 20 |
| | 1 | Plow borrow pits | 1 | T-5 | 5/14" | 150 | 5 | 5 | | 5 | | 5 |
| | 2 | Repair checks | 1 | T-5 | Martin Ditcher 6-7' | 50 | 15 | 15 | | 15 | | 15 |
| | 1 | Placing boxes | 2 | T-5 | Tumble bug scraper | 75 | 10 | 20 | | 10 | 10 | 20 |
| | 1 | Closing checks | 1 | T-5 | T.B. Scraper | 150 | 5 | 5 | | 5 | | 5 |
| | 2 | Closing checks | 1 | T-5 | T.B. Scraper | 150 | 5 | 5 | | 5 | | 5 |
| | 1-2 | Fertilizer | 1 | 1 ½T | Truck and driver[b] | 120 | 7 | 7 | | | | 7 |
| | 1-2 | Fertilizing (Airplane-custom) | | | | | | | | | | |

Table 17 --continued--

Table 17 - Continued.

| Month and period | Field | Operation | Crew: Man | Crew: Power | Equipment size | Acres per 10 hr. day | Requirements: Power | Requirements: Man | Days available | Labor required: Operator | Labor required: Hired | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Acres | Hours | | Days | Hours | | Hours |
| | 1-2 | Flooding | 2 | | | 20 | | | | 28 | 47 | 75 |
| | 1-2 | Seeding | 1 | 1 ½T | Truck and driver b/ | | | 15 | | | | 15 |
| | 1-2 | Seeding (airplane-custom) | | | | | | | | | | |
| May 1-10 | 1-2 | Irrigating | 1 | | | | | 100 | 10 | 100 | | 100 |
| May 11-31 | 1-2 | Irrigating | 1 | | | | | 190 | 21 | 190 | | 190 |
| June 1-30 | 1-2 | Irrigating | 1 | | | | | 60 | 30 | 60 | | 60 |
| | 3 | Knock checks and float | 1 | T-5 | Float and 5/14" | 50 | 15 | 15 | | 15 | | 15 |
| | 3 | Plowing | 1 | T-5 | 5/14" | 16 | 47 | 47 | | 47 | | 47 |
| July 1-31 | 1-2 | Irrigating | 1 | | | | | 62 | 31 | 62 | | 62 |
| | 3 | Disking | 1 | T-5 | 12' | 30 | 25 | 25 | | 25 | | 25 |
| | 3 | Landplane | 1 | T-5 | 10' x 60' landplane c/ | 12.5 | 60 | 60 | | 60 | | 60 |
| | 3 | Chisel | 1 | T-7 d/ | 10' chisel d/ | 22.5 | 34 | 34 | | 34 | | 34 |
| August 1-31 | 1-2 | Irrigating | 1 | | | | | 62 | 31 | 62 | | 62 |
| Sept. 1-31 | 1-2 | Drain | | | | | | 10 | 26 | 10 | | 10 |
| | 1-2 | Open checks | 1 | T-5 | T.B. Scraper | 150 | 10 | 10 | | 10 | | 10 |
| October 1-14 | 1-2 | Harvesting | 1 | S.P. Sm Pusher | | 11.25 | 107 | 134 | 14 | 134 | | 134 |
| | | | 1 | T-5 | Bankout W. | | 107 | 134 | | | 134 | 134 |
| | | | | 1 ½T | Truck and driver b/ | | 134 | 134 | | | | 134 |
| | | Total | | | | | | | | 1,103 | 191 | 1,460 |

Table 17 --continued--

Table 17 - Continued.

a/ Custom hired T-7, checker, and driver to use with owned T-5 in checking.

b/ Custom hired truck (1 $\frac{1}{2}$ ton) = $2.00/ton for rice fertilizer and seed hauled from town.

c/ Custom hired 10' x 60' landplane. $1.00 per hour.

d/ Custom hired T-7 and chisel, pays fuel and repairs cost.

TABLE 18

Calendar of Operations, 300 Acres Rice and 150 Acres Summer Fallow: 150 Acres First Year, 150 Acres Second Year Rice. (Tractors include a T-5 and a T-3)

| Month and Period | Field | Operation | Crew | | Equipment size | Acres per 10 hr. day | Requirements | | Days available | Labor Required | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Man | Power | | | Power | Man | | Operator | Hired | |
| | | | | | | Acres | Hours | | Days | Hours | | Hours |
| March 11-20 | 1 | Plowing | 1 | T-5 | 5/14" | 16 | 70 | 70 | 7 | 70 | | 70 |
| | | | 1 | T-3 | 4/14" | 10 | 38 | 38 | | | 38 | 38 |
| March 21-31 | 2 | Disking | 1 | T-5 | 12' | 30 | 50 | 50 | 7 | 50 | | 50 |
| | 1 | Floating | 1 | T-5 | 12' x 30' | 30 | 20 | 20 | | 20 | | 20 |
| April 1-10 | 1 | Floating | 1 | T-5 | 12' x 30' | 30 | 30 | 30 | 7 | 30 | | 30 |
| | 1 | Survey (custom | | | | | | | | | | |
| | 2 | Plowing | 1 | T-5 | 5/14" | 14 | 40 | 40 | | 40 | | 40 |
| | | | 1 | T-3 | 4/14" | 10 | 70 | 70 | | | 70 | 70 |
| April 11-20 | 2 | Plowing | 1 | T-5 | 5/14" | 14 | 17 | 17 | 7 | 17 | | 17 |
| | 2 | Floating | 1 | T-5 | 12' x 30' | 30 | 50 | 50 | | 50 | | 50 |
| | 1 | Plow contours | 1 | T-3 | 4/14" | 150 | 10 | 10 | | | 10 | 10 |
| April 21-30 | 1 | Plow checks | 1 | T-5 | 5/14" | 150 | 10 | 10 | 10 | 10 | | 10 |
| | 1 | Checking a/ | 2 | T-5 rent T-7, driver | Rent checker | 100 | 15 | 15 | | 15 | | 30 |
| | 1 | Plow borrow pits | 1 | T-5 | 5/14" | 150 | 10 | 10 | | 10 | | 10 |
| | 1-2 | Harrowing b/ | 1-2 | T-5 | 20' | 50 | 60 | 60 | | 30 | 30 | 60 |
| | 2 | Repair checks | 1 | T-5 | Ditcher | 50 | 30 | 30 | | 30 | | 30 |
| | 1 | Placing boxes | 2 | T-3 | Dozer | 200 | 8 | 16 | | | 16 | 16 |
| | 1-2 | Closing checks | 1 | T-3 | Dozer | 150 | 10 | 10 | | | 10 | 10 |
| | 1-2 | Fertilizer | 1 | Truck | | 120 | 13 | 13 | | | 13 | 13 |
| | 1-2 | Fertilizing (Plane-custom) | | | | | | | | | | |

Table 18 --continuted--

Table 18 - Continued.

| Month and period | Field | Operation | Crew | | Equipment size | Acres per 10 hr. day | Requirements | | Days available | Labor required | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Man | Power | | | Power | Man | | Operator | Hired | |
| | | | | | | Acres | Hours | | Days | Hours | | Hours |
| May 1-10 | 1-2 | Flooding | 2 | | | | | 150 | 10 | 100 | 50 | 150 |
| | 1-2 | Seeding | 1 | | | | | 30 | | | 30 | 30 |
| | 1-2 | Seeding (plane-custom) | | | | | | | | | | |
| May 11-31 | 1-2 | Irrigating | 1 | | | | | 210 | 21 | 210 | | 210 |
| June 1-30 | 3 | Knocking checks-floating | 1 | T-5 | 5/14" | 50 | 30 | 30 | 30 | 30 | | 30 |
| | 3 | Plowing | 1 | T-5 | 5/14" | 16 | 94 | 94 | | 94 | | 94 |
| | 1-2 | Irrigating | 1 | | | | | 120 | | 120 | | 120 |
| July 1-31 | 1-2 | Irrigating | 1 | | | | | | 31 | 60 | 64 | 124 |
| | 3 | Disking | 1 | T-5 | 12' | 37.5 | 40 | 40 | | 40 | | 40 |
| | 3 | Landplane | 1 | T-5 | 10' x 60' | 12.5 | 120 | 120 | | 120 | | 120 |
| | 3 | Chiseling c/ | 1 | Rent T-7 | Rent chisel | 22.5 | 67 | 67 | | 67 | | 67 |
| Aug. 1-31 | 1-2 | Irrigating | 1 | | | | | | 31 | 124 | | 124 |
| Sept. 1-30 | 1-2 | Drain. | | | | | | 20 | 26 | 20 | | 20 |
| | 1-2 | Open checks | 1 | T-3 | Dozer | 300 | 10 | 10 | | 10 | | 10 |
| Oct. 1-14 | 1-2 | Harvesting | 1 | Self-propelled harvester | | 11.25 | 106 | 133 | 14 | 133 | | 133 |
| | | | | Self-propelled harvester | | 11.25 | 106 | 133 | | | 133 | 133 |
| | | Bankout | 1 | T-5 | Bankout wagon | | 106 | 133 | | | 133 | 133 |
| | | Hauling | 2 | Two 1 ½ Ton truck | | | 266 | 266 | | | 266 | 266 |
| | | Total | | | | | | | | 1,500 | 863 | 2,378 |

Table 18 --continued--

Table 18 - Continued.

a/ Custom hires a checker, T-7 and driver at the rate of $10.00 per hour.

b/ Hires man for 30 hours of night work (harrowing), following floating on fields 1-2.

c/ Custom hires T-7 at $3.50 per hour, pays fuel and field repairs and furnishes a driver.

Table 15 - Continued.

3/ Custom hires a cancer, T-7 and driver at the rate of $10.00 per hour.

4/ Hires man for 30 hours of brush work (harrowing), following floating on field 1-6.

5/ Custom hires T-7 at $3.50 per hour, pays fuel and field repairs and furnishes a [illegible].

TABLE 19

Calendar of Operations for 450 Acres of Rice and 225 Acres of Summer Fallow. (Tractors include - T-7, and a T-3 for bulldozer operation.)

| Month and period | Field | Operation | Crew | | Equipment size | Acres per 10 hr. day | Requirements | | Days available | Labor required[a] | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Man | Power | | | Power | Man | | Operator | Hired | |
| | | | | | | Acres | Hours | | Days | Hours | | Hours |
| March 11-20 | 1 | Plowing | 1 | T-7 | 10/14" plow | 20 | 113 | 113 | 7 | 56.5 | 56.5 | 113 |
| | 2 | Disking | 1 | T-7 | 20' disk | 37.5 | 60 | 60 | | 13.5 | 13.5 | 27 |
| March 21-31 | 2 | Disking | | | | | | | 7 | 16.5 | 16.5 | 33 |
| | 1 | Floating | 1 | T-7 | 12x30' float | 45 | 50 | 50 | | 25 | 25 | 50 |
| | 1 | Surveying | | | Custom | | | | | | | |
| | 2 | Plowing | 1 | T-7 | 10/14" | 16 | 140 | 140 | | 28 | 28 | 56 |
| April 1-10 | 2 | Plowing | | | | | | | 7 | 42 | 42 | 84 |
| | 1 | Plow contours | 1 | T-3 | 4/14" | 150 | 15 | 15 | | 7.5 | 7.5 | 15 |
| | 2 | Floating | 1 | T-7 | 12' x30' float | 45 | 50 | 50 | | 20 | 20 | 40 |
| April 11-20 | 2 | Floating | | | | | | | 7 | 5 | 5 | 10 |
| | 1 | Plowing checks | 1 | T-7 | 10/14" | 100 | 23 | 23 | | 11.5 | 11.5 | 23 |
| | 1 | Checking | 1 | T-7 | Checker[b] | 150 | 15 | 15 | | | 15 | 30 |
| | 1 | Plowing borrow | 1 | T-7 | 10/14" | 150 | 15 | 15 | | 7.5 | 7.5 | 15 |
| | 1-2 | Disking pits and harrowing | 1 | T-7 | 20' disk and harrow | 37.5 | 120 | 120 | | 31 | 31 | 62 |
| April 21-30 | 1-2 | Disking and harrowing | | | | | | | 10 | 29 | 29 | 58 |
| | 2 | Repairing checks | 1 | T-7 | Ditcher | 150 | 15 | 15 | | 5 | 10 | 15 |
| | 1 | Placing boxes | 2 | T-3 | Dozer | 200 | 11 | 11 | | 11 | 11 | 22 |
| | 1 | Closing checks | 1 | T-3 | Dozer | 150 | 15 | 15 | | 15 | | 15 |
| | 2 | Closing checks | | T-3 | Dozer | 150 | 15 | 15 | | 15 | | 15 |
| | 1-2 | Fertilizing | 1 | | Truck | 120 | | 38 | | | 38 | 38 |
| | | Fertilizing | | Plane-custom | | | | | | | | |
| | 1-2 | Flooding | 2 | | | | | 225 | | 25 | 12 | 37 |

Table 19 --continued--

Table 19 - Continued.

| Month and period | Field | Operation | Crew: Man | Crew: Power | Equipment size | Acres per 10 hr. day | Requirements: Power | Requirements: Man | Days available | Labor required a/: Operator | Labor required a/: Hired | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Acres | Hours | | Days | Hours | | Hours |
| May 1-10 | | Flooding | | | | | | | 10 | 60 | 128 | 188 |
| | 1-2 | Seeding | 1 | | | | | 40 | | 40 | | 40 |
| | | Seeding | Plane-custom | | | | | | | | | |
| May 11-31 | 1-2 | Irrigating | | | | | | | 21 | 210 | | 210 |
| | 3 | Knocking checks and floating | 1 | T-7 | 10/14" and float | 60 | 38 | 38 | | | 38 | 38 |
| | 3 | Plowing | 1 | T-7 | 10/14" | 20 | 113 | 113 | | | 113 | 113 |
| June 1-30 | 1-2 | Irrigating | | | | | | | 30 | 150 | | 150 |
| | 3 | Disking | 1 | T-7 | 20' disk | 37.5 | 60 | 60 | | | 60 | 60 |
| | 3 | Landplaning | 1 | T-7 | 12' L.plane | 20 | 113 | 113 | | 73 | 40 | 113 |
| July 1-31 | 1-2 | Irrigating | | | | | | | 31 | 155 | | 155 |
| | 3 | Chiseling | 1 | T-7 | 10' chisel | 22.5 | 100 | | | 100 | | 100 |
| August 1-31 | 1-2 | Irrigating | | | | | | | 31 | 155 | | 155 |
| Sept. 1-30 | 1-2 | Draining | 1 | | | | | 20 | | 20 | | 20 |
| | 1-2 | Opening checks | 1 | T-3 | Dozer | 150 | 30 | 30 | | 30 | | 30 |
| October 1-20 | 1-2 | Harvesting | 1 | S.P. | Combine | 11.25 | 160 | 200 | | 200 | | 200 |
| | | | 1 | S.P. | Combine | 11.25 | 160 | 200 | | | 200 | 200 |
| | | Banking out | 1 | T-3 | Bankout wagon | 11.25 | 160 | 200 | | | 200 | 200 |
| | | | 1 | T-7 | Bankout wagon | 11.25 | 160 | 200 | | | 200 | 200 |
| | | Hauling | 2 | 1 ½T | Trucks | 22.50 | 400 | 400 | | | 400 | 400 |
| | | Total | | | | | | | | 1,557 | 1,758 | 3,330 |

a/ Hires man for March 10 through June 9th and again for 1 month at harvest to run one of the combines.

b/ Custom hires a T-7 and driver to help pull the checker.

TABLE 20

Calendar of Operations, 600 Acres Rice and 300 Acres Summer Fallow: 300 First Year, 300 Second Year Rice
(Tractors include a T-7 and a T-5)

| Month and period | Field | Operation | Crew: Man | Crew: Power | Equipment size | Acres per 10 hr. day | Requirements a/: Power | Requirements a/: Man | Days available | Labor required b/: Operator | Labor required b/: Hired | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Acres | Hours | | Days | Hours | | Hours |
| March 11-20 | 1 | Plowing | 1 | T-7 | 10/14" | 20 | 140 | 140 | 7 | 140 | | 140 |
| March 21-31 | 1 | Plowing | 1 | T-5 | 5/14" | 16 | 13 | 13 | 7 | 13 | | 13 |
| | 2 | Disking | 1 | T-7 | 20' | 37.5 | 80 | 80 | | 80 | | 80 |
| | 1 | Floating | 1 | T-5 | 12' x 30' | 30 | 17 | 17 | | 17 | | 17 |
| | 1 | Floating | 1 | T-7 | 12' x 30' | 45 | 30 | 30 | | 30 | | 30 |
| April 1-10 | 1 | Floating | 1 | T-5 | 12' x 30' | 30 | 40 | 40 | 7 | | 40 | 40 |
| | 2 | Plowing | 1 | T-7 | 10/14" | 16 | 140 | 140 | | 140 | | 140 |
| | 2 | Plowing | 1 | T-5 | 5/14" | 14 | 10 | 10 | | | 10 | 10 |
| | 1 | Survey | Custom | | | | | | | | | |
| April 11-20 | 2 | Plowing | 1 | T-5 | 5/14" | 14 | 45 | 45 | 7 | 45 | | 45 |
| | 2 | Floating | 1 | T-7 | 12' x 30' | 45 | 67 | 67 | | 67 | | 67 |
| | 1 | Plow Contours | 1 | T-5 | 5/14" | 150 | 20 | 20 | | 20 | | 20 |
| April 21-30 | 1 | Plow checks | 1 | T-5 | | 150 | 20 | 20 | 10 | | 20 | 20 |
| | 1 | Checking c/ | 2 | T-7 | Checker | 150 | 20 | 20 | | 20 | | 40 |
| | 1 | Plow Bor. Pits | 1 | T-5 | | 150 | 20 | 20 | | 20 | | 20 |
| | 1 | Disk Harrow | 1 | T-7 | 20' | 37.5 | 80 | 80 | | 80 | | 80 |
| | 2 | Disk Harrow | 1 | T-7 | 20' | 37.5 | 80 | 80 | | 80 | | 80 |
| | 2 | Repair checks | 1 | T-7 | Ditcher | 150 | 20 | 20 | | 20 | 20 | 20 |
| | 1 | Placing Boxes | 2 | T-5 | Dozer | 200 | 15 | 30 | | | 30 | |
| | 1 | Closing checks | 1 | T-5 | Dozer | 180 | 17 | 17 | | | 17 | 17 |
| | 2 | Closing checks | 1 | T-5 | Dozer | 180 | 17 | 17 | | | 17 | 17 |
| | 1-2 | Fertilizer | 1 | | Truck | 120 | 50 | 50 | | | 50 | 50 |
| May 1-10 | 1-2 | Flooding | 3 | | | | | 300 | 10 | 300 | | 300 |
| | 1-2 | Seeding | 1 | | | | | 60 | | | 60 | 60 |
| | | Seeding | (custom-airplane) | | | | | | | | | |

Table 20 --continued--

Table 20 - Continued.

| Month and period | Field | Operation | Crew | | Equipment size | Acres per 10 hr. day | Requirements[a] | | Days available | Labor required[b] | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Man | Power | | | Power | Man | | Operator | Hired | |
| | | | | | | Acres | Hours | | Days | Hours | | Hours |
| May 11-31 | 1-2 | Irrigating | 1 | | | | | 420 | 21 | 420 | | 420 |
| June 1-30 | 3 | Knocking checks and Floating | 1 | T-7 | 10/14" | 60 | 50 | 50 | 30 | 50 | | 50 |
| | 3 | Plowing | 1 | T-7 | 10/14" | 20 | 150 | 150 | | 150 | | 150 |
| | 1-2 | Irrigating | 1 | | | | | 240 | | 240 | | 240 |
| July 1-31 | 1-2 | Irrigating | 1 | | | | | | 31 | 248 | | 248 |
| | 3 | Disking | | T-7 | 20' | 45 | 67 | 67 | | 67 | | 67 |
| | 3 | Landplaning | | T-7 | 12' x 60' | 20 | 150 | 150 | | 150 | | 150 |
| August 1-31 | 1-2 | Irrigating | | | | | | 248 | 31 | 248 | | 248 |
| | 3 | Chiseling | 1 | T-7 | 10' chisel | 22.5 | 134 | 134 | | 134 | | 134 |
| Sept. 1-30 | 1-2 | Draining | 1 | | | | | 40 | 26 | 40 | | 40 |
| | 1-2 | Opening checks | 1 | T-5 | Dozer | 300 | 20 | 20 | | 20 | | 20 |
| | 1-2 | Harvesting | | | | | | | | | | |
| Oct. 1-14 | | | 1 | | S.P. Pusher | 11.25 | 91[d] | 114 | | 114 | | 114 |
| | | | 1 | | S.P. Pusher | 11.25 | 91 | 114 | | 114 | | 114 |
| | | | 2 | T-7 | 16' pull combine | 15.0 | 182 | 228 | | | 228 | 228 |
| | | | 1 | T-7[e] | 16' pull combine | 15.0 | | 114 | | | 114 | 228 |
| | | Banking out | 1 | T-5 | B.O. Wagon | | 91 | 114 | | | 114 | 114 |
| | | Banking out | 1 | T-3 | B.O. Wagon | | 91 | 114 | | | 114 | 114 |
| | | Banking out | 1 | T-5[f] | B.O. Wagon | | 91 | | | | | 91 |
| | | Banking out | 1 | T-7[g] | B. O. Wagon | | 91 | | | | | 91 |
| | 1-2 | Hauling | 3 | 3-1½ | T. Trucks | | 342 | 342 | | | 342 | 342 |
| | | Total | | | | | | | | 3,047 | 1,176 | 4,539 |

Table 20 -- continued --

Table 20 - Continued.

a/ Night work is performed during rush seasons.

b/ Labor crew consists of one year around hired man. A tractor driver hired for two months March 11 through May 10 and for a month at harvest and an irrigator who is employed from May 1 through September 4. Other help is hired as needed. Hours of employees hired by the month are recorded under column entitled "regular." Hours listed in the "hired" column are persons employed by the hour. The operator spends full time managing the business.

c/ Custom hires one T-7 and operator to help with the checking operation.

d/ Combine harvesters are expected to have 8 hours running time during a 10 hour working day.

e/ Custom hires one 16 foot pull type combine plus a T-7 and driver for $125 per day.

f/ Custom hires one T-5 and driver for pulling a bankout wagon at $32 per day.

g/ Custom hires one bankout wagon, T-7 and driver for $45 per day.

This size of operation also typically uses much more harvesting equipment and labor than the smaller ones. Typically the two self-propelled combines used for 300 and 450 acres will be supplemented with a larger combine pulled by the T-7 or by a large self-propelled machine. There was also a greater tendency to hire further equipment and rush the harvest to completion. On the smaller acreages the operators tried to complete their harvest without hiring additional equipment and men. This calendar, Table 20, assumes that another pull combine plus its tractor and two bank-out wagons plus tractors would be hired. This hiring of harvesting equipment was typical of these larger operations.

## The Inventory of Tractors and Allied Equipment Determines the Amount of Hired Labor Needed and the Terms of Hiring

On a farm with 300 acres of rice.--The operator who is using a T-7 tractor on 300 acres of rice is able to provide almost all of the labor required for seedbed preparation and for irrigation. The operator's labor input from Table 21 may be summarized as follows:

| Item | Amount |
|---|---|
| Tractor driving | 643 hours |
| Other labor | 811 hours |
| Total for operator | 1,454 hours |

If this labor is valued at the same rate per hour as would have been necessary to hire some one to do it the value of the operator's unpaid labor would be as follows:

| Item | Value |
|---|---|
| Tractor driving | $ 803.75 |
| Other labor | 1,010.00 |
| Total all unpaid labor | $1,813.75 |
| Total value per acre of rice | $ 6.04 |

Hired labor.--If this operator had a regular hired man he would be a local person hired by the day when needed. It is estimated that 9 days or 90 hours of tractor driving would be required during seedbed preparation and the building of levees. Another tractor driver would be hired for 133 hours to drive a tractor on a bankout wagon at harvest time. For nontractor labor, 8 hours of placing boxes, 25 hours for fertilizing, and 100 hours for flooding would be used. At harvest time a skilled operator would be hired for 133 hours on the self-propelled combine and two truck drivers would be required for a total of 266 hours. This would give a total of 755 hours of hired labor used, compared with 1,454 hours supplied by the operator. Hired labor would cost $1,182 Including all charges, the total hired labor cost per care of rice would equal $4.10.

TABLE 21

Labor Inputs on 300 Acres Rice and 150 Acres Summer Fallow: 150 Acres First Year, 150 Acres Second Year Rice. (Operator used 65 DB horsepower tractor as the principal source of power, and performs a maximum number of the jobs.)

| Operation | Performed by operator | | | | Hired labor | | |
|---|---|---|---|---|---|---|---|
| | Tractor operator | Other labor | Value | Rate per hour | Tractor operator | Other labor | Value |
| | Hours | Hours | Dollars | Dollars | Hours | Hours | Dollars |
| Seedbed preparation | 315.00 | -- | 393.75 | 1.25 | 40.00 | -- | 50.00 |
| Irrigation preparation | 43.00 | -- | 53.75 | 1.25 | 50.00 | -- | 62.50 |
| | -- | -- | -- | 1.00 | -- | 8.00 | 8.00 |
| Fertilizing | -- | -- | -- | 1.25 | -- | 25.00 | 31.25 |
| Flooding | -- | 50.00 | 50.00 | 1.00 | -- | 100.00 | 100.00 |
| Seeding | -- | 30.00 | 30.00 | 1.00 | -- | -- | -- |
| Summer fallow | 275.00 | -- | 343.75 | 1.25 | -- | -- | -- |
| Irrigating | -- | 578.00 | 578.00 | 1.00 | -- | -- | -- |
| Draining | 10.00 | -- | 12.50 | 1.25 | -- | -- | -- |
| | -- | 20.00 | 20.00 | 1.00 | -- | -- | -- |
| Harvesting | | | | Rate per day | | | |
| Self-propelled combine | -- | 133.00 | 332.00 | 25.00 | -- | 133.00 | 332.50 |
| Banking out | -- | -- | -- | 15.00 | 133.00 | -- | 199.50 |
| Hauling | -- | -- | -- | 15.00 | -- | 266.00 | 399.00 |
| Total tractor | 643.00 | -- | 803.75 | -- | 223.00 | -- | 312.00 |
| Total other | -- | 811.00 | 1,010.00 | -- | -- | 532.00 | 870.75 |
| Total all | -- | 1,454.00 | 1,813.75 | -- | -- | 755.00 | 1,182.75 |
| + State Compensation Insurance (@ $4.00 per $100 of hired labor) | | | | | | | 47.32 |
| Total labor cost | | | | | | | 1,230.07 |
| Total per acre of rice | -- | 4.85 | 6.04 | | | 2.52 | 4.10 |

Source: Table 16.

Comparison of labor inputs.--The estimated amounts of labor used, including both the operators and hired labor, and the pattern of hiring on typical farms of different sizes are shown in Table 22. The farm producing rice on 300 acres with a T-7 tractor uses labor valued at $9.98 per acre which is the lowest dollar input for labor of the several sizes of farms that have been described above. Labor costs are $11.18 per acre and $10.64 per acre, respectively, on the farm producing 150 acres of rice and the farm with 300 acres of rice using a T-5 tractor. These are slightly higher than for 300 acres with the T-7 because of the slower rates of performance with the smaller tractors. On these three farms, labor is hired by the day, mostly at harvest time.

On farms with larger rice acreages the cost per acre for labor is higher primarily because the operator hires semi-permanent or permanent full-time hired labor at a monthly cost in order to assure himself of a labor supply when needed, and is unable to employ all labor fully. The hours of labor used per acre are essentially the same, 7.36, 7.40 and 7.55 - for the farms with 300, 450 and 600 acres of rice. But the method of hiring tends to make the cost per acre higher on the larger farms. On the farm with 450 acres of rice a tractor driver is hired for three months in the spring and summer and one month at harvest time. A monthly wage of $350 is allowed for this work. On the farm with 600 acres of rice one man is hired on an annual basis at $300 per month and another is hired for two months in the spring and one month at harvest time at a monthly wage of $350. On this size of farm the operator is listed as performing none of the actual labor but is free to devote his entire time to management. This is true of some farm operators interviewed. In other cases the operator actually performs some or all of the irrigation and operates a self-propelled combine at harvest because he likes to do so.

The labor cost of $13.02 per acre on the farm with 600 acres of rice is the highest for any of the five situations presented. This relatively greater cost is especially important because it is entirely for hired labor, and therefore a

cash cost, while the operator's labor on the smaller farms represents an opportunity cost, and is actually a return to the operator rather than a cash outlay. Using cost of hired labor only, the $13.02 per acre on the largest farm should be compared with the following:

| | | |
|---|---|---|
| | 450 acres | $5.78 |
| T-7 | 300 " | 3.94 |
| T-5 | 300 " | 4.37 |
| | 150 " | 1.72 |

TABLE 22

Estimated Amounts and Cost of Labor Used, Terms of Hiring, on Typical 150, 300, 450 and 600 Acre Rice Farms

| Hiring period and type of work | 150 acres | | T-5 300 acres | | T-7 300 acres | | 450 acres | | 600 acres | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Time | Total cost | Time | Total cost | Time | Total cost | Time | Total cost | Time | Total cost |
| | Hours | Dollars | Hours | Dollars | Hours | Dollars | Hours | Dollars | Hours | Dollars |
| Hired labor | | | | | | | | | | |
| Annually | | | | | | | | | 12 months | 3,600 |
| Monthly | | | | | | | | | | |
| Tractor driver | | | | | | | 958 4 months | 1,400 | 3,047 3 months | 1,050 |
| Irrigator | | | | | | | | | 4+ months | 1,240 |
| Daily or Hourly | | | | | | | | | | |
| Harvest | 134 | 201.00 | 532 | 931.00 | 532 | 931.00 | 800 | 1,200 | 912 | 1,596 |
| Other seasonal | 57 | 57.00 | 331 | 379.00 | 223 | 251.75 | | | 264 | 324 |
| Total hired | 191 | 258.00 | 863 | 1,310.00 | 755 | 1,182.75 | 1,758 | 2,600 | 4,223 | 7,810 |
| Per acre of rice | 1.27 | 1.72 | 3.23 | 4.37 | 2.51 | 3.94 | 3.91 | 5.78 | 7.03 | 13.02 |
| Operator | | | | | | | | | | |
| Unpaid labor | | | | | | | | | | |
| Summer fallow | 181 | 226.25 | 351 | 438.75 | 275 | 343.75 | 173 | 216.25 | | |
| Others | 922 | 1,192.00 | 1,149 | 1,444.00 | 1,179 | 1,470.00 | 1,384 | 1,783.75 | | |
| Total | 1,103 | 1,418.25 | 1,500 | 1,882.75 | 1,454 | 1,813.75 | 1,557 | 2,000.00 | | |
| Per acre of rice | 7.35 | 9.46 | 5.10 | 6.18 | 4.85 | 6.04 | 3.46 | 4.44 | | |
| Hired and Unpaid Labor | | | | | | | | | | |
| Total | 1,294 | 1,676.25 | 2,363 | 3,192.75 | 2,209 | 2,996.50 | 3,315 | 4,600.00 | 4,223 | 7,810 |
| Per acre | 8.62 | 11.18 | 7.87 | 10.64 | 7.36 | 9.98 | 7.37 | 10.22 | 7.03 | 13.02 |

Source: From calendars of operations and budgets.

TABLE 23

Physical Inputs of Labor Per Acre of Rice on 53 Colusa and Sutter County Farms, 1950

| Group and Operations | Hours Per Acre | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Average | | High | | Low | | Typical | |
| | Tractor | Other | Tractor | Other | Tractor | Other | Tractor | Other |
| Group I (30-80 A.) | | | | | | | | |
| Tillage operations | 1.73 | 0 | 3.50 | 0 | .72 | 0 | 2.00 | 0 |
| Checking | .32 | .27 | .78 | .38 | .10 | .10 | .35 | .35 |
| Irrigation | 0 | 2.62 | 0 | 6.83 | 0 | 2.13 | 0 | 6.00 |
| Seeding | 0 | .34 | - | - | - | - | - | - |
| Harvesting | - | - | - | - | - | - | Contract | |
| Group II (120-160 A.) | | | | | | | | |
| Tillage | 1.77 | 0 | 3.12 | 0 | .90 | 0 | 1.70 | 0 |
| Checking | .56 | .67 | 3.42 | 1.85 | .03 | .07 | .35 | .40 |
| Irrigation | 0 | 5.37 | 0 | 9.94 | 0 | 2.08 | 0 | 4.00 |
| Seeding | 0 | .10 | 0 | .22 | 0 | .06 | 0 | .07 |
| Harvesting | 1.36 | 2.76 | 2.20 | 4.08 | .33 | 1.29 | 1.50 | 2.50 |
| Total tractor & other | - | 12.59 | - | (24.83) | - | (4.76) | | 10.52 |
| Group III(220-330 A.) | | | | | | | | |
| Tillage | 1.63 | 0 | 4.92 | 0 | .93 | 0 | 1.60 | 0 |
| Checking | .30 | .40 | .72 | 2.21 | .02 | .04 | .33 | .20 |
| Irrigation | 0 | 3.86 | 0 | 7.08 | 0 | 2.34 | 0 | 3.55 |
| Seeding | .23 | .20 | .27 | .40 | .18 | .04 | 0 | .20 |
| Harvesting | 1.29 | 2.54 | 3.31 | 6.42 | .38 | .86 | 1.30 | 2.50 |
| Total tractor & other | - | 10.45 | - | - | - | - | - | 9.68 |
| Group IV (360-640 A.) | | | | | | | | |
| Tillage | 1.57 | 0 | 2.54 | 0 | .42 | 0 | 1.60 | 0 |
| Checking | .27 | .24 | .57 | .74 | .08 | .02 | .25 | .25 |
| Irrigation | .05 | 2.17 | .07 | 4.65 | .02 | 1.81 | 0 | 2.74 |
| Seeding | 0 | .09 | 0 | .17 | 0 | .03 | 0 | .09 |
| Harvesting | .98 | 1.48 | 1.77 | 2.36 | .36 | .60 | .85 | 1.55 |
| Total tractor & other | - | 6.85 | - | - | - | - | - | 7.33 |

Source: Summarized from farm interview data.

Summary of Physical Inputs of Labor Per Acre of Rice on Farms Studied Shows a Wide Range

The calendars of operations and tables of labor inputs developed thus far have been based on specific inventories of equipment, specific acreages, and typical inputs. Data showing actual inputs on rice fields in 1950 will serve to illustrate the range of inputs on actual farms and show how the "typical" inputs from the calendars compare with those compiled from the field records. Data on actual inputs are summarized in Table 23.

This table represents the summary of hours of farm labor used per acre in production of harvesting of the 1950 crop on 53 rice farms. The farms are grouped according to size of rice acreage on the farm in that year. Group I had 30 to 80 acres of rice; Group II from 120 to 160 acres, Group III from 220 to 330 acres and Group IV from 360 to 640 acres. Some of these farms also had other crops in that year but no account is taken of that fact in this table of inputs of labor on the rice fields.

The operations performed during the year are divided into five categories as follows: (1) tillage operations, including the seedbed preparation and fertilization; (2) checking operations which typically included surveying, the plowing of contours and checks, checking, plowing pits, closing checks and placing boxes; (3) irrigation operations which included flooding, tending of the irrigation during the summer, and draining; (4) seeding operations, which typically included labor actually provided by the farmer for soaking seed or providing a flagman for guiding airplanes in seeding - in two cases the rice was seeded by surface machinery rather than by plane; (5) harvesting, which included the labor required for operating combines and tractors for banking out the rice and, in most cases, for truck drivers to move the rice from the fields to an assembly point.

Four different measures of inputs per acre are given for each category of operations. These summarize the totals used by the individual farms in performing

the operations. For example, the average of 1.73 hours per acre of tractor driver labor used for tillage operations in Group I is a simple arithmetic average of the hours of labor performed by the farmer or his hired employees in these operations on individual farms. The typical input of 2.00 hours per acre for the same group and category of operations is more representative of the group. It gives the best single estimate of inputs for farms this size and was obtained by considering those farms that did not appear to have either abnormally high or abnormally low inputs in this category. The range from .73 to 3.50 hours per acre shows the lowest and the highest inputs on individual farms.

Labor of custom equipment operators, such as airplane pilots is not included in these totals, but where a large amount of the work in a category not typically performed by custom operators was hired for a particular farm, observations from that farm were not used in the averages and totals that would be affected. Harvesting labor is not included in the summary for the Group I farms because contract harvesting is typical in this group.

In the classifying the labor of tractor drivers and other workers, tractor labor includes operators of self-propelled bankout wagons but not operators of self-propelled combines or trucks. Other labor is primarily for irrigation but also includes harvester and truck operation, placing of boxes, surveying and other jobs that require a small amount of nontractor labor. One important omission from the table is the labor involved in herding migratory waterfowl away from the fields. Time reported on this item was too variable to summarize.

The variations in inputs for the different operations, for example the range from .90 to 3.12 hours per acre for tillage in Group II, are caused by different physical conditions such as drainage, variations in practices from farm to farm, and different combinations of tractors and equipment.

The sums of the average labor inputs for each type of operation are equal to 12.59 hours for Group II, 10.45 hours for Group III, and 6.85 hours for

Group IV. These are the inputs that would be found on a single farm that had inputs for tillage equal to the average for its group, inputs for checking equal to the average for its group, and so on through the different operations. The sums of the labor inputs for typical inputs are more useful because they are not influenced as much by unusually high or low farms. Typical inputs were equal to 10.52 hours for Group II farms, 9.68 hours for Group III farms and 7.33 hours for Group IV farms.

Totals are not computed for the high and low columns. These totals would be misleading, because no one farm was high or low in all of the items listed and the totaling of these extremes exaggerates the range. The range from high to low, which would be 24.8 to 4.76 hours in the 120-160 acre group is exaggerated in both directions by combining all the high inputs or all the low ones. This exaggeration does not exist in totaling the average or typical columns.

Although these farms are stratified according to rice acreage, and there would appear to be a decrease in labor inputs as the rice acreage is increased from that of Group I or II to Group IV, it should be stressed that organization of the individual farm may be far more important in determining the amount of labor needed than the actual acreage on the farm. For example, comparing Groups II and IV, one sees that in harvesting labor the low of 1.29 hours for Group II is well below the high of 2.36 hours for Group IV. This fact prevents us from saying that it takes less labor per acre to harvest on the larger farm than it does on the smaller farm. We can say that average harvesting labor inputs are lower on the larger farm, and that the large farm typically has lower labor requirements than the smaller farm.

Comparison with calendars.--The typical inputs in the 120-160 acre group of farms - Table 23, total 10.52 hours of labor per acre. The total from the calendar of operations for the 150 acre farm as summarized in Table 22, is 9.73. The difference is mostly in harvest labor where the typical for the field

data is 4.00 hours compared with 2.68 for the synthetic data. Higher inputs in field data were caused primarily by the practice of handling rice in sacks, rather than in bulk, on 7 of the 11 farms of this size for which data were obtained in 1950. This required 1 or 2 more men per combine and more labor to load the bank sacks. Bulk handling has been assumed in the calendar of operations used in analyses because it has become almost universal since 1950.

Variations between the computed 7.93 hours for the 300 acres with the T-5 and 7.36 for the 300 acres with the T-7 in Table 22 and the 9.68 hours for the 220-330 acre group Table 23, also reflect this change in harvesting practices. They also reflect some lowering of inputs per acre because the 300 acre figure is above the average size for the 220-330 acre group.

Of all groups, the synthetic data from the 600 acre rice farm with 7.55 hours per acre and the 360-640 acre group figure of 7.33 hours per acre are closest. Harvest inputs were more nearly the same here. Sack handling was not as widely used in the larger group of actual farms. Only 2 of 12 studied used sacks in 1950.

## Other Inputs and Costs for a Farm With 300 Acres of Rice and a 65 D.B.H.P. Tractor Include Materials Needed, Costs of Owning and Operating Machinery, and Custom Services Hired

Materials.--Seed used in each farm size is the most expensive material. Some farmers may save their own seed from rice that they have grown. At the other extreme are those who purchase certified seed. For purposes of budgeting costs, a value of $7 per hundredweight will be used for seed. A rate of seeding

of 160 pounds per acre will be used. This makes an average cost per acre for seed of $11.20, Table 29.[1/]

Application of fertilizer varies from farm to farm and field to field as discussed above. Rates have increased since 1950. In estimating costs, an average of 250 pounds per acre of ammonium sulphate--21-0-0--at a price of $3.00 per hundredweight of fertilizer will be assumed, giving a cost of $7.50 per acre of rice.

These are the principal materials used. On some fields spray is used for killing of weeds and insects. This may be purchased by the farmer or included in the contract price paid to a commercial applicator.

The other major item purchased is water. The majority of the rice farms are supplied with water from a system of canals. Water is generally purchased on a per acre basis. In 1950 rates per acre for rice ranged from $6-15. At that time a rate of $7 was being charged over a large part of the rice growing area. Delivered price of water has increased slightly since 1950 and the price of $8.50 per acre will be included under irrigation costs in budgets. Those rice growers who pump from their own wells, or from the rivers or drainage canals, will have only the cost of pumping with no charge for the water itself.[2/]

Inputs of machinery.--The calendar of operations developed for this size of farm gives a total annual use of 781 hours for the 65 horsepower tracklaying tractor. This machine is the most important single item of equipment. The

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1/ The seeding rate varies from 140 to 180 pounds. These large amounts of seed are considered necessary for broadcasting into the water. No attempt is made to get tillering of plants, rather a large enough amount of seed is sown to obtain a thick, heavy stand and get some weed control from crowding.

2/ Farmers interviewed estimated that from 6-12 acre feet of water was being used according to soils characteristics.

Application of [illegible] field is increased above. [illegible] In addition [illegible] amounts of [illegible] pounds per acre of [illegible] per hectare-foot of fertilizer will be [illegible] of [illegible] per acre of [illegible].

[illegible] weed spray is used [illegible] killing of weeds and insects. This may be performed by the [illegible] the contract price paid to a commercial applicator.

The other major item considered is water. The majority of the [illegible] are supplied with water from a system of canals. Water is generally [illegible] [illegible] from [illegible]. At [illegible] large part of the rice [illegible]. [illegible] increased [illegible] 30% and irrigation on 44,[illegible] acre will [illegible] continued under irrigation cases in [illegible]. These rice [illegible] only the cost of pumping [illegible].

[illegible] of [illegible].--The [illegible] of operations [illegible] for this [illegible] farm gives a total annual use of 781 hours for the [illegible] tractor. This [illegible] is the most [illegible] [illegible] operation. The

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1/ The working rate varies from [illegible] to 20 [illegible]. [illegible] are considered [illegible] and [illegible] do not [illegible] [illegible] a [illegible] [illegible] a [illegible] 8, heavy [illegible] [illegible].

2/ Farmers interviewed [illegible] that from [illegible] acre foot of water was being [illegible] done on [illegible] [illegible].

variable costs of operating this tractor--fuel, lubrication, and maintenance--are summarized in Table 24. Of these costs, maintenance at $ .633 per hour is the major item, and the total of all variable costs of tractor operation is $3.44 per acre of rice produced.

Trucks are another major expense. This inventory shows two trucks and one pickup. The pickup will be driven an estimated 12,500 miles per year and the two trucks 2,500 miles apiece. This figure would vary greatly depending upon the location of the farm relative to the assembly area to which the rice is hauled and also upon the residence of the operator relative to his rice land. Operating costs for trucks, as summarized in Table 25, add another $1.56 per acre to total costs.

The self-propelled harvester is a major item of equipment and fuel, lubrication, and repairs make up its major operating costs. A repair cost of $15 per day during rice harvest is used in estimating production costs.[1/] Costs of $1.92 per acre in Table 26 are based on 106 hours for each of the two machines in harvesting 300 acres of rice. To complete the harvest in this time it would be necessary for each machine to harvest 11.25 acres per day. This is quite possible in good weather with good rice. The acreage per day would be considerably less when harvesting rice that has lodged or is tough because of wet weather.

Fixed costs.--The costs discussed in the preceding section have included only variable costs. That is, the expenses that would be incurred when the machinery is operating. In addition, there are costs that will be incurred whether the machinery is used at all, or regardless of the acreage that is covered. For example, annual depreciation for the 65 horsepower tractor is estimated at $420.

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1/ Some growers reported spending as much as $30 per day for rice harvest on some of the older self-propelled machines. The repair costs on these harvesters is especially high in years when heavy rains fall during the harvest season.

Variable costs of operating the tractor--fuel, lubrication, and maintenance--are summarized in Table 24. Of these costs, maintenance at $ .17 per hour is the major item, and the total of all variable costs of tractor operation is $2.44 per acre of rice produced.

Trucks are another major expense. This inventory shows two trucks and one sleeper. The sleeper will be driven an estimated 12,000 miles per year and the two trucks 8,000 miles apiece. This figure would vary greatly depending upon the location of the farm relative to the assembly area to which the rice is hauled and also upon the residence of the operator relative to his rice lands. Operating costs for trucks, as summarized in Table 25, add another $1.86 per acre to total costs.

The self-propelled harvester is a major item of equipment and fuel, lubrication, and repairs make up its major operation costs. A repair cost of $15 per day during rice harvest is used in estimating production costs.[1] Costs of $1.92 per acre in Table 26 are based on 100 hours for each of the two machines in harvesting 300 acres of rice. To complete the harvest in this time it would be necessary for each machine to harvest 11.25 acres per day. This is quite possible in good weather with good rice. The average per day would be considerably less when harvesting rice that has lodged or is tough because of wet weather.

Fixed costs.--The costs discussed in the preceding section have included only variable costs. That is, the expenses that would be incurred when the machinery is operating. In addition, there are costs that will be incurred whether the machinery is used or not, or regardless of the acreage that is covered. For example, annual depreciation for the 25 horsepower tractor is estimated at $200.

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[1] Some growers reported operating as much as $50 per day for rice harvest on some of the older self-propelled machines. The repair costs in these harvesters are necessarily high in years when heavy rains fall during the harvest season.

TABLE 24

Physical Inputs and Variable Costs for Operating the 65 DB Horsepower Tractor

| Item | Unit | Rate of use | Total used | Cost per unit | Total Cost |
|---|---|---|---|---|---|
| | | Units | | Dollars | |
| Diesel fuel | gallons | 3.5 gallons per hour[a] 4.5 gallons per hour[b] | 3,408.5 | .14 | 477.19 |
| Lubrication grease | pounds | 1 pound per 10 hours | 78.1 | .15 | 11.72 |
| Crankcase oil | quarts | 19 per 100 hours | 148.39 | .19 | 28.19 |
| Oil filter | each | 1 per 100 hours | 8 | 2.50 | 20.00 |
| Maintenance | -- | per hour | 781 | .633 | 494.37 |
| Total variable cost | | | | | 1,031.47 |
| Total variable cost per acre of rice produced | | | | | 3.44 |

a/ Light work

b/ Heavy work

Source: Based on summaries of interview data from farmers, suppliers of petroleum products and machinery service agencies.

TABLE 25

Annual Use and Variable Costs for Operating Trucks

| Item | Use per year | Fuel consumption | | Cost per gallon | Cost of fuel | Service per 1,000 miles | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Miles per gallon | Total | | | | Total | |
| | miles | | gallons | | | dollars | | |
| 1/2 ton pickup | 12,500 | 12 | 1,041.67 | .26 | 270.83 | 2.00 | 25.00 | 380.83[a/] |
| 1 1/2 ton truck | 2,500 | 8 | 312.50 | .26 | 81.25 | 2.00 | 5.00 | 86.25 |
| 1 1/2 ton truck | 2,500 | 8 | 312.50 | .26 | 81.25 | 2.00 | 5.00 | 86.25 |
| Total | | | 1,666.67 | | 433.33 | | 35.00 | 468.33 |
| Cost per acre of rice | | | | | | | | 1.56 |

a/ Includes an added $85 toward the cost of replacing tires and battery. No maintenance other than lubrication is charged for the trucks because of their low annual mileage.

Source: Summaries of interview data from farmers and suppliers of fuels and service.

A further fixed cost of $121 is estimated for such items as batteries, and fan belts that deteriorate with time, and certain items of lubrication that are performed as a function of time rather than by the amount of use. This gives a total fixed cost of $541, or $1.80 per acre of rice. Fixed costs for the self-propelled combine are much higher. Annual repairs to put these machines in condition for operation are estimated at $500 per machine, and depreciation is greater than for the tractor because of a shorter useful life.

Fixed costs for the seven self-propelled equipment items summarized in Table 27, total $15.72 per acre of rice or $4,715 for 300 acres. This amount of fixed cost becomes highly important when we consider a reduction in acreage from the 300 shown here. In addition to these items, there are depreciation charges on other machinery of $1,012 from Table 14, page 45. Also personal property taxes on machinery are estimated at $315 per year, to be paid whether the machines are operated or not.

Rental and custom services.--The high fixed costs on owned machinery are an incentive to use rented equipment and custom services, but these may not always be available immediately when needed. On this size of farm a complete inventory has been assumed in order that all operations may be performed at the proper time. Only slight use of rented equipment is made. One 65 horsepower tractor is rented for use in checking the 150 acres of new rice. A surveyor is paid 50 cents per acre for surveying; airplane service is paid $1.00 per hundredweight for seeding and 85 cents per hundredweight for applying the fertilizer. The major item of custom service is for drying. This operator would pay 30 cents per hundredweight on the wet weight of rice delivered to the drier. This would be an estimated $3,387 or $11.29 per acre. Expenditures for rental of equipment and custom services to supplement owned equipment are summarized in Table 28.

TABLE 26

Variable Cost for Operating Two Self-Propelled Harvesters 106 Hours on 300 Acres of Rice[a]

| Item | Cost per harvester | | | | Total for two |
|---|---|---|---|---|---|
| | Rate of use | Cost per unit | Units used | Total | |
| | | Dollars | | Dollars | Dollars |
| Gasoline . . . . . | 2.5 gallons per hour | .26 | 265.0 | 68.90 | 137.80 |
| Lubricating. . . . . (grease) | 5 pounds per day | .15 | 66.5 | 9.98 | 19.96 |
| Crankcase oil. . . . | 15 quarts per 60 hours | .19 | 26.5 | 5.04 | 10.08 |
| Oil filters . . . . | 1 per 60 hours | 2.50 | 2.0 | 5.00 | 10.00 |
| Repairs . . . . . | $15 per day | — | -- | 199.50 | 399.00 |
| | | | | 288.42 | 576.84 |
| Cost per hour of operation | | | | 2.72 | 5.44 |
| Cost per acre of rice harvested | | | | | 1.92 |

a/ 8 hour day operation for harvesters; 10 for labor.

Source: Based on interview data collected from farmers.

TABLE 27

Annual Fixed Costs for Self-Propelled Equipment

| Item | Depreci-ation | Maintenance and repairs | License and insurance | Total | Per acre of rice produced |
|---|---|---|---|---|---|
| | Dollars | | | | |
| 65 h.p. Tractor | 420.00 | 121.08 | -- | 541.08 | 1.80 |
| 30 h.p. Tractor | -- | 54.94 | -- | 54.94 | .18 |
| ½ Ton Truck | 400.00 | -- | 85.00 | 485.00 | 1.62 |
| 1½ Ton Truck | 400.00 | -- | 130.00 | 530.00 | 1.77 |
| 1½ Ton Truck | 400.00 | -- | 130.00 | 530.00 | 1.77 |
| S.P. Combine | 787.50 | 500.00 | -- | 1,287.50 | 4.29 |
| S.P. Combine | 787.50 | 500.00 | -- | 1,287.50 | 4.29 |
| Total | $3,195.00 | $1,177.01 | $345.00 | $4,715.01 | $15.72 |
| Cost per acre of rice produced | $ 10.65 | $ 3.92 | $ 1.15 | $ -- | $ -- |

Source: Table 14 and interview data with farmers and service agencies.

TABLE 28

Equipment Rented and Custom Services Hired to Supplement Owned Equipment

| Operation | Equipment | Payment rate | Total cost | Cost per acre of rice |
|---|---|---|---|---|
| | | Dollars | | |
| Custom work | | | | |
| Surveying | -- | .50 per acre | 75.00 a/ | .25 |
| Seeding | Airplane | 1.00 per cwt. | 480.00 | 1.60 |
| Fertilizing | Airplane | .85 per cwt. | 637.50 b/ | 2.12 |
| Drying | -- | .30 per cwt. | 3,386.70 c/ | 11.29 |
| Equipment rental | | | | |
| Checking | 65 HP tractor and driver | 7.00 per hour | 70.00 | .23 |
| Total cost | | | 4,649.20 | |
| Cost per acre | | | | 15.49 |

a/ Only 150 acres surveyed each year.

b/ 200 lbs. fertilizer per acre on the 150 acres of rice grown the first year, and 300 lbs. on the same area at the second year. Average of 250 lbs. per acre.

c/ Drying cost based on weight before drying.

Source: Based on data from farm interviews.

Summary of the Estimated Gross Expenses for the Farm With 300 Acres of Rice Indicate a Total Cost of $2.33 Per Hundredweight

Total fixed costs are equal to $7,127 for the production of rice on 300 acres and the working of 150 acres of summer fallow. Variable expenses are equal to $17,355, giving a total of $24,482 for gross expenses for the year - Table 29. These costs, including cash expenses and depreciation, equal $81.61 per acre of rice harvested, or $2.33 per hundredweight of dry paddy rice assuming a 35 hundred weight yield.[1/] They do not include the value of the labor supplied by the operator, interest on investment (other than operating capital), or any charge for management.

Of the $24,482 total costs, $7,127 or 29 percent are fixed costs.

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1/ These costs per acre are presented in a different form in Appendix Table 3. Cultural, harvest, and summer fallow costs are itemized by operation to arrive at total cash and depreciation costs per acre.

TABLE 29

Farm Budget Summary for a Farm Producing 300 Acres of Rice Per Year; Gross Expenses[a]

| Gross expenses | Total | | | Per Acre | |
|---|---|---|---|---|---|
| | Fixed | Variable | Sub-total | Item | Sub-total |
| | Dollars | | | | |
| **Labor:** | | | | | |
| Harvest | | 931 | | 3.10 | |
| Other seasonal | | 239 | | .80 | |
| State Comp. Ins. | | 47 | | .16 | |
| | | | 1,217 | | 4.06 |
| **Materials:** | | | | | |
| Seed | | 3,360 | | 11.20 | |
| Fertilizer | | 2,250 | | 7.50 | |
| | | | 5,610 | | 18.70 |
| **Irrigation:** | | | | | |
| Ditches (rep. and depr.) | 225 | | | .75 | |
| Water | | 2,550 | | 8.50 | |
| | | 180 | | .60 | |
| | | | 2,955 | | 9.85 |
| **Field Power:**[c] | | | | | |
| T-7 repairs | 100 | 494 | | 1.98 | |
| T-3 repairs | 50 | 12 | | .21 | |
| Fuel | | 512 | | 1.71 | |
| Lubrication | 26 | 63 | | .30 | |
| Depreciation[d] | 470 | | | 1.40 | |
| | | | 1,677 | | 5.60 |
| **Trucks and Pickups:** | | | | | |
| Trucks-overhead and fuel | 260 | 172 | | 1.44 | |
| Pickup-overhead and fuel | 85 | 381 | | 1.55 | |
| Depreciation-trucks and pickup | 1,200 | | | 4.00 | |
| | | | 2,098 | | 6.99 |
| **Machinery:** | | | | | |
| Harvesters | | | | | |
| repairs | 1,000 | 399 | | 4.67 | |
| fuel | | 138 | | .46 | |
| lubrication | | 40 | | .13 | |
| depreciation | 1,575 | | | 5.25 | |
| Other machinery | | | | | |
| repairs | | 295 | | .98 | |
| depreciation | 1,012 | | | 3.37 | |
| | | | 4,459 | | 14.86 |
| **Taxes on Machinery:** | 315 | | 315 | 1.05 | 1.05 |
| **Improvements:** (shed) | | | | | |
| Depreciation | 120 | | | .40 | |
| Tax | 36 | | | .12 | |
| Maintenance | 50 | | | .17 | |
| | | | 206 | | .69 |

Table 29 --continued--

Table 29 - Continued.

| Gross expenses | Total | | | Per acre | |
|---|---|---|---|---|---|
| | Fixed | Variable | Sub-total | Item | Sub-total |
| | Dollars | | | | |
| Interest on Operating Capital | | 343 | 343 | 1.14 | 1.14 |
| Real Estate: | | | | | |
| Taxes e/ | 653 | | 653 | 2.18 | 2.18 |
| Duck Control | | 300 | 300 | 1.00 | 1.00 |
| Custom and Rental: | | | | | |
| Seeding | | 480 | | 1.60 | |
| Surveying | | 75 | | .25 | |
| Checking | | 70 | | .23 | |
| Drying | | 3,387 | | 11.29 | |
| Fertilizing | | 637 | | 2.12 | |
| | | | 4,649 | | 15.49 |
| Total b/ | 7,127 | 17,355 | 24,482 | 81.61 | 81.61 |

a/ Computed for a farm using 65 drawbar horsepower tracklayer tractor (T-7) as the principal source of power. A 25 to 30 horsepower tractor (T-3) is used for light work.

b/ These costs include cash expenses and depreciation. They do not include the value of the labor supplied by the operator, interest on investment (other than borrowed operating capital), or any charge for management.

c/ Some repairs--replacement of batteries, etc., are considered as fixed expenses because they are a function of time rather than use. The lubrication cost is also divided between fixed and variable to cover the practice of changing oil in such parts as final drives every six months.

d/ The second tractor (T-3) has been fully depreciated on many farms. The depreciation is all for the larger tractor.

e/ Taxes are computed for 495 acres, assuming 450 acres of cropland plus 10 percent of that acreage as wasteland, ditches, etc.

Gross Expenses on Farms Budgeted With Different Rice Acreages and Different Inventories of Equipment Range From $2.21 to $2.57 Per Hundredweight. 1/

Constant costs.--Totals for all those costs for inputs that remain constant for each acre of rice vary in proportion to rice acreage - Table 30. These include, under the assumptions used here, real estate or taxes on land; water--which is the principal cost in irrigation; all materials--seed and fertilizer; most of the custom charges--seeding, fertilizing, surveying, and drying; and duck control.2/ The similarity in costs per acre for the different sizes of farms is due in large part to this fixity of costs per acre, regardless of the number of acres operated. Its importance can be emphasized by noticing that for the 300 acres of rice using a T-7 tractor, these constant costs add up to $46 per acre, or 57 percent of the total of $81.

This may understate the percentage of costs that are constant. In those instances where the same item of equipment is used on farms of different sizes and where rates of performance are the same regardless of total acreage covered, variable costs of operation would be constant. This would be true of the self-propelled combine used on all five farms budgeted here, and for the variable costs of operating the T-7 tractor for tillage operations on several farms. In fact, the cost of tractor power changes approximately in proportion to acreage on these farms except for the 300 acres with the lighter inventory.

Decreasing costs.--Those costs that do not increase in proportion to acreage or output will add less to the cost per hundredweight as output increases. Costs of improvements to real estate are so treated in Table 30, but this will not always be true in reality. There was a wide variation in the storage buildings found on rice farms. Costs shown here would cover a shop and storage space

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1/ Farm budget summaries for the different sizes of rice farms, showing inputs and prices used are given in Appendix Tables 4, 5, 6 and 7.

2/ Duck control is the most difficult of these costs to estimate. However, the assumption of changes in proportion to acreage seems realistic. On larger acreages, access to the center of large fields becomes more difficult and therefore more costly.

TABLE 30

Costs of Production on Farms With 150, 300, 450, 600 Acres of Rice

| Gross expenses | Total Cost | | | | |
|---|---|---|---|---|---|
| | 150 | 300 a/ | 300 b/ | 450 | 600 |
| | Dollars | | | | |
| Real estate | 327 | 653 | 653 | 981 | 1,307 |
| Improvements | 206 | 206 | 206 | 206 | 206 |
| Labor | 268 | 1,362 | 1,217 | 2,704 | 8,122 |
| Irrigation | 1,477 | 2,955 | 2,955 | 4,599 | 6,360 |
| Field power | 863 | 1,446 | 1,677 | 2,437 | 3,271 |
| Trucks and pickups | 807 | 2,097 | 2,097 | 2,233 | 3,667 |
| Machinery c/ | 2,177 | 4,062 | 4,459 | 5,037 | 6,407 |
| Materials | 2,805 | 5,610 | 5,610 | 8,415 | 11,220 |
| Operating capital (interest) | 166 | 335 | 343 | 500 | 754 |
| Custom charges | 2,731 | 4,964 | 4,649 | 6,974 | 11,601 |
| Duck control | 150 | 300 | 300 | 450 | 600 |
| Personal property taxes | 156 | 269 | 315 | 326 | 488 |
| Total gross expenses d/ | 12,133 | 24,259 | 24,481 | 34,862 | 54,003 |
| Cost per acre | 80.89 | 80.86 | 81.60 | 77.47 | 90.00 |
| Cost per cwt. e/ | 2.31 | 2.31 | 2.33 | 2.21 | 2.57 |

a/ Using a 45 DBHP tractor as principal source of power.

b/ Using a 65 DBHP tractor as principal source of power.

c/ Cost of machinery repairs are given in Appendix Tables 4,5,6, 7. Depreciation is computed as in Table 14.

d/ These include cash expenditures and depreciation. The values of labor and management supplied by the farm operator are not included. Interest on investment is not included. Interest on operating expenses during the season is included for the time from use of the funds until one month after harvest. This corresponds to the practice of using short-term production credit to cover these expenses.

e/ Assuming a yield of 35 cwt. per acre.

Source: Computed from data obtained from interviews with farmers and suppliers of items used in production.

for most of the machinery. Personal property taxes on machinery provide a better example. They double between 150 acres and 300 acres with a T-7, indicating constant costs @ 3¢ per cwt. but when acreage increases to 450 they drop to 2¢ per cwt. With the increased equipment needed for 600 acres these costs are 2.3¢ which represents a lower figure than on the 150 and 300 acre organizations, and they would decline further if acreage is expanded beyond 600 with no increase in equipment and no decrease in yield per acre.

Increasing costs.--Costs of hired labor increase more than in proportion to acreage or output for the farms shown in Table 30. As acreage and output are doubled, from 150-300 acres, these labor costs increase approximately five times. The increase is greater with the same size of tractor than with the larger T-7 which uses more capital in relation to labor. On a per hundredweight basis hired labor costs compare as follows:

| Acres | Dollars Per Hundredweight |
|---|---|
| 150 | 0.05 |
| 300 (T-5) | 0.13 |
| 300 (T-7) | 0.12 |
| 450 | 0.17 |
| 600 | 0.39 |

The cost of machinery, other than tractors and trucks, increased as acreage increased, but tended to rise and then fall as the fixed costs of repairs and depreciation were spread over more acres. On 300 acres, machinery costs when using a T-5 as the principal tractor equalled $4,062 or 39¢ per hundredweight. For the same acreage and output, ownership and use of the T-7 and associated inventory incurred costs of $4,459 or 42¢ per hundredweight. Use of this T-7 and the same inventory to operate 450 acres of rice, assuming the same yield per acre, lowered the cost per hundredweight to 32¢.

Comparison of total costs.--As used here, total costs include cash costs and depreciation. These are the items that determine what will be left from gross farm income for the use of the operator. The depreciation charge is the means

of recovering previous investment by charging a part of the original total against the current year's crop. Costs per hundredweight or per acre in Table 30 show no significant difference between these production costs for farms with 150 or 300 acres of rice. Despite the differences in labor, power and other individual cost items, there is only a few cents difference in cost per acre, and a spread of only 2¢ per hundredweight of rice produced.

When acreage is expanded from 300 to 450 for the organization with the T-7 tractor, estimated cost per acre drops by $4.13. This could be an important saving. It would make an appreciable difference in income. With rice @ $4.25 per hundredweight, and assuming no charge in harvesting costs other than drying, the net return per hundredweight would be $3.93. The difference in cost of $4.13 would then be equivalent to a difference in yield of $4.13/$3.93 or 129 pounds of rough rice per acre.

The most important cost comparison is the difference between $90 per acre for total costs on the farm with 600 acres of rice and the sharply lower values for the totals on all other farms. This $90 total represents $2.75 per hundredweight of rice, the margin between $2.75 per hundredweight and $2.21 for the farm with 450 acres of rice would mean a difference in net income per acre of $12.60:

$$\begin{aligned} 35 \text{ cwt. } (\$4.25-\$2.21) &= \$71.40 \\ 35 \text{ cwt. } (\$4.25-\$2.57) &= \underline{\phantom{0}58.80} \\ & \phantom{=} \$12.60 \end{aligned}$$

The farm with 300 acres of rice and the T-5 produced rice at a slightly lower cost than the one with the same acreage and the T-7. It was done with an average investment of some $2,700 less for equipment. Any adverse conditions at harvest time or at planting time, however, might increase the cost per hundredweight on this organization above the costs on the farm with a T-7. With the larger tractor there would be greater flexibility, and the excess capacity would permit coping with a shorter time period in the spring or fall.

The decrease in cost, as the same inventory of equipment is used to produce rice on 450 rather than 300 acres, represents a spreading of fixed costs of equipment over a greater output of rice.

Variation in costs among actual farms.--The data used here are typical of those observed in the field in 1950-1953 for a concentration of farms that had similar inventories and cropping systems. The costs presented above for this type of farm have been discussed as "the costs of production" but there were some extreme cases where costs would have varied greatly from these, even though acreage and yield were nearly the same. Table 31 shows some of the variations found on farms producing from 220 to 450 acres of rice in 1950 compared with values used in determining the "typical costs" for that year.

These indicate the major differences in cash operating costs found on survey farms of this size that were engaged in the production of only rice. The range here from $-6.23 below "typical" to $32.58 above, or $38.71, illustrates the risk of increased costs that may occur in rice production.

The cost of water is determined independently of any conditions on the particular farm; it is "given" to the manager as the price he will pay for water. The increased cost of fertilizer occurred on farms attempting to get average or better yields on soils or below average fertility. All of the other items in the column that show higher than typical costs result from adverse weather or biological problems. All of these are not likely to occur on a given farm in any one year, but such a combination could happen. If it did, the farm operator who thought that his cash operating costs were going to be comparable to those shown above as "typical" might finish the season with this portion of his costs as much as 50 percent higher than anticipated.

The costs that exceed the "typical" in this tabulation occurred on only a few farms in 1950. They are so erratic in their occurrence that they were not "typical" on any given farm that year, in the sense that they would not usually appear as costs. By the summer of 1953 they were considered more probable expenditures on most farms visited. Heavier fertilization and more sprays for insect and weed control, for example, were being used on fields that had been continuously planted to rice without a nonirrigated year to control pests.

TABLE 31

Range in Selected Cost Items on Rice Farms in 1950

| Item | Low | High | Typical |
|---|---|---|---|
| Hired labor | $ 2.60 | $10.60 | $ 3.32 |
| Fertilizer | .00 | 11.97 | 2.66 |
| Application | .00 | 3.84 | .85 |
| Water | 6.00 | 14.00 | 7.00 |
| Spraying weeds | .00 | 3.00 | .00 |
| Spraying tadpole shrimp | .00 | 2.50 | .00 |
| Duck control | .00 | 1.50 | 1.00 |
| Total | $ 8.60 | $47.41 | $14.83 |
| Typical costs | 14.83 | 14.83 | |
| Margin below typical | $-6.23 | | |
| Margin above typical | | $32.58 | |

Source: Interviews with farmers.

To reflect these increases the budgeted costs in Table 29 include increases from the "typical" costs found in 1950 for these specific items:

| | 1950 | Used here for 300 acres of rice |
|---|---|---|
| Hired labor | $ 3.32 | $ 4.06 |
| Fertilizer | 2.66 | 7.50 |
| Application | .85 | 2.12 |
| Water | 7.00 | 8.50 |
| | $13.83 | $22.18 |
| | | 13.83 |
| Increase | | $ 8.35 |

## Comparison of Net Farm Incomes for the Budgeted Farms Shows That Income Does Not Increase in Proportion to Acreage of Rice

Gross return will be computed using the yield of 35 hundredweight and a price of $4.25 per hundredweight for dry paddy rice, farm basis at harvest time, to determine estimated net farm incomes for the different sizes of rice farms being analyzed.

With the calendars of operations and inputs that have been developed, net farm income for a farm producing 35 hundredweight of rice on 300 acres, using the T-7 and inventory of equipment associated with it from Table 15, would equal $20,143.

This net farm income as shown in Table 32 is the amount that the farm business returns to the farm operator in payment for his capital invested in land, equipment, and other items, his own labor, and his management.[1/] It is based on reasonably goo weather conditions and reasonably good yields. The yields might be exceeded by several hundredweight in unusually good weather years. On the other hand, they migh not be achieved in years when weather is unusually bad for rice production.[2/]

Table 32 gives a comparison of net farm income for different sizes of rice farms. The net income of $20,143 on the 300 acres of rice is more than double that on the 150 acres because costs increased less than income as the acreage was increased. Doubling of rice acreage from 300 to 600 failed to double net farm income--the first 300 acres producing a net farm income of $20,143 and the second 300 adding only $15,247.

The farm with 600 acres of rice shows a net income only $3,288 greater than that from the farm with 450 acres of rice. Several factors explain this small

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1/ This would be the net farm income for an owner-operator. As pointed out above, two-thirds of the rice growers in 1950 were producing all or part of their rice on rented land. In that case, the net income would be divided between the landlord and the tenant.

2/ In 1957, preliminary estimates indicated an average yield per acre for Californi of 41 hundredweight per harvested acre. The 1956 yield was 42 hundredweight. These contrasted with the 1954 yield per acre planted of 24 hundredweight. Agricultural Marketing Service, Grain Division, Annual Market Summary of California Rice, (San Francisco, Federal State Market News Service) Nov. 30, 1956.

[illegible]

income gain. In order to increase from 450 to 600 acres of rice the inventory of equipment had to be expanded by adding another tractor and harvester. This means a major increase in land working and harvesting capacity, which the 600 acres of rice was unable to use to capacity. This is partly because growers were cautious about expecting as much from any given tractor at this acreage as at smaller acreages. The greater absolute risk of loss in event of equipment failure caused them to own greater harvester and tractor capacity per acre than growers with smaller acreages of rice. Growers in this size class also used more labor per acre. They hired a full time hired man by the year and several men by the month. The costs in Tables 30 and 32 are based on the assumption that the owner-operator will devote his time entirely to supervision. Cash costs would be lowered if the owner displaced some of the hired labor with his own labor.

With the comparison of net farm incomes shown in this section, one might question why any operators would be found in this size class. Three reasons can be cited. (a) Combinations of equipment can be adjusted or acreage can be expanded for this inventory and thereby lower costs per unit (but not all the reasons for increased costs can be overcome). (b) During the past 10 years, prices for rice have been much higher than the $4.25 used as a probable future price. Th rise in price from $4.25 to $5.00 would add $15,750 to the net farm income of the farm with 600 acres of rice, but only $11,812 to the farm with 450 acres. (c) Higher yields explain why some rice growers have been producing on 600 or more acres. Many such larger growers are farming on soils that give higher average yields than the 3,500 pounds used here.

Ranges in costs.--Costs may vary from year to year according to weather conditions; with adverse conditions a farmer would incur added costs in an attempt to maintain yield. In cool years such as 1954 and 1953 many growers would be forded to incur added expenses for weed or insect spraying, possibly added fertilizer, added costs of irrigation, and harvesting. Such additions might be

TABLE 32

Comparison of Net Farm Incomes for Different Sizes of Rice Farms

| Acres | Quantity produced cwt. a/ | Price | Gross receipts | Gross expenses d/ | Net farm income e/ |
|---|---|---|---|---|---|
| 150 | 5,250 | 4.25 | 22,312 | 12,989 | 9,323 |
| 300 b/ | 10,500 | 4.25 | 44,625 | 24,276 | 20,349 |
| 300 c/ | 10,500 | 4.25 | 44,625 | 24,482 | 20,143 |
| 450 | 15,750 | 4.25 | 66,938 | 34,836 | 32,102 |
| 600 | 21,000 | 4.25 | 89,250 | 53,860 | 35,390 |

a/ Based on a yield of 35 cwt. of dry paddy rice per acre.

b/ Using a 45 drawbar horsepower tractor and appropriate inventory of equipment.

c/ Using a 65 drawbar horsepower tractor and appropriate inventory of equipment.

d/ Using gross expenses from Table 30.

e/ This would be the net farm income of an owner-operator. When the rice is produced by a renter, this amount would be divided between the landlord and the tenant according to the terms of the lease. Tenants in 1950 were realizing from 60 to 70 per cent of the net income.

as follows:

| | Per Acre |
|---|---|
| Weed spraying | $ 3.00 |
| Insect spraying or dusiting | 3.00 |
| Cost of an added 100 # of fertilizer | 3.00 |
| Cost of draining and reflooding | 5.00 |
| | $14.00 x 300 = $4,200 |

If so, the added costs would cause net farm income on the farm with 300 acres of rice to shrink from $20,143 to $15,943 at yield of 35 hundredweight and a price of $4.25.

## The Effects of Changes in Price and Yield on Net Farm Income Can Be Estimated from the Budget Data

A decline in price would cause gross farm income to be less at every yield and, therefore, would cause net farm income to become negative at a higher yield. Assuming the same price for rice at all levels of yield, the gross returns from various prices ranging from $4.25 per hundredweight down to $3.00 per hundredweight for dry rice are illustrated by the price lines in Figure 1. Gross returns can be read directly from the left hand margin of this chart.

The total cost of production as shown in Table 29 is given by $TC_a$. The only change in costs shown here as yields decrease in the actual cost of drying rice which declines by 32¢ for each hundredweight of yield reduction.[1/] A reduction in yield from 35 to 25 hundredweight brings about a reduction of costs equal to: 10 hundredweight (32¢) per acre or $3.20 (300 acres) = $960 for the farm illustrated in Figure 1.

A range in yield from 25 to 35 hundredweight can occur merely because of weather conditions, or because of differences in conditions from farm to farm or field to field. These physical differences are great enough that this range in yield may occur even with the same inputs. There might be some difference in the cost of harvesting, banking out, and hauling with the lower quantity of rice. No attempt is made here to measure the decrease in total cost from such possible decreases in handling charges.[2/]

The increased costs of $14.00 associated with more spraying, fertilizing, and added costs of irrigation are shown by the total cost line $TC_b$. For different farms of which this organization, inventory, and inputs would be typical, costs should lie somewhere between $TC_a$ and $TC_b$ in any given year.

At a price of $4.25 per hundredweight and a yield of 3,500 pounds of dry

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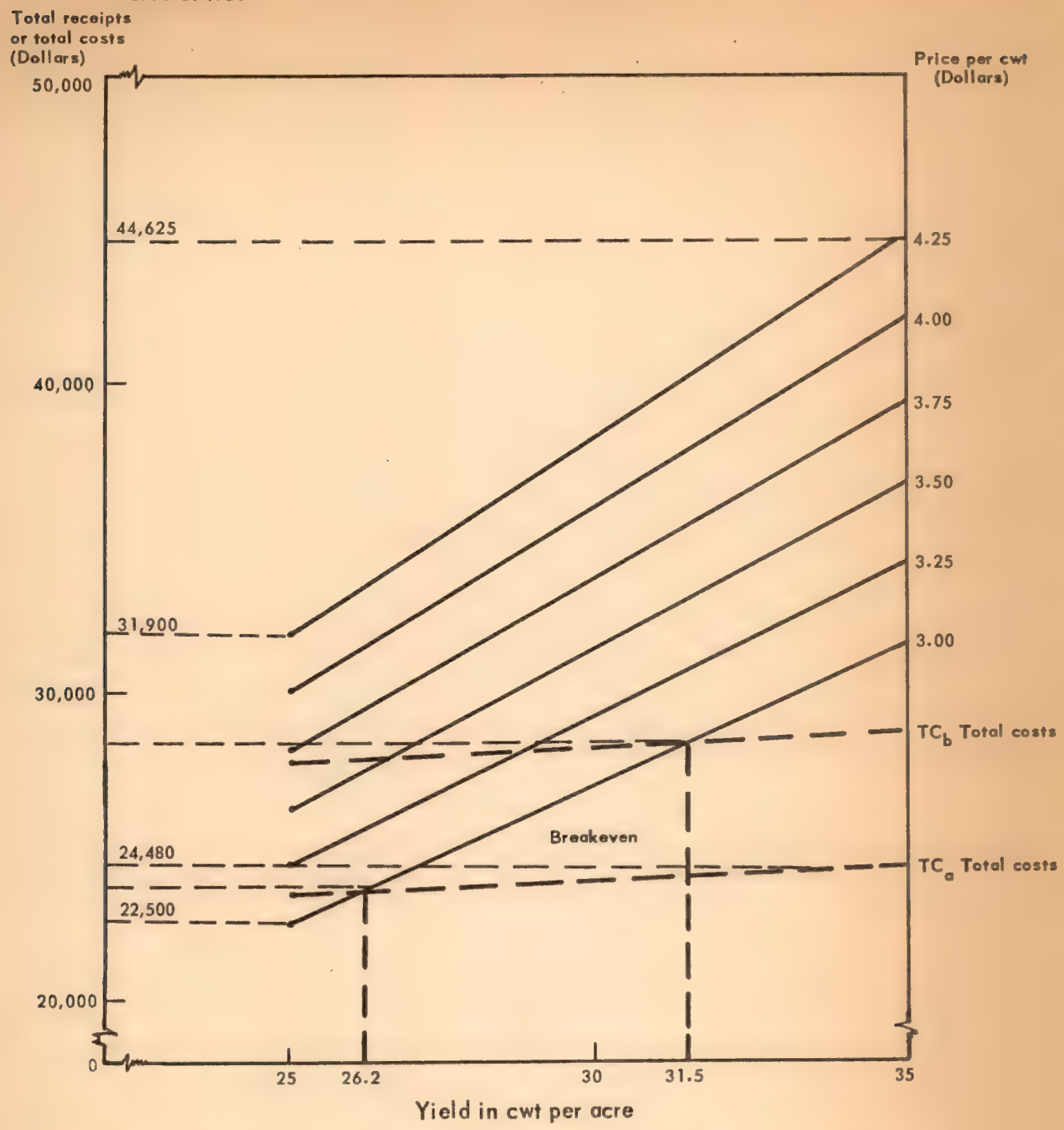
1/ $\frac{\text{37.63 cwt. of undried rice per acre} \times \$.30}{\text{35 cwt. of dried rice}}$ = $0.32 per cwt. of dried rice.

2/ There is also the possibility that the harvesting of the lower yield might be more costly if it is the result of adverse weather conditions at harvest time.

Figure 1. Price and yield changes and net farm income; owner-operator farm with 300 acres of rice




Net farm income equals total receipts minus total costs. The upper cost level, $TC_b$, reflects higher costs for spraying weeds and insects, fertilization and irrigation and harvest. These cost increases are not uncommon, but are not universal. Weather conditions that lower the yield are likely to cause farmers to incur some or all of them in any particular year.

Source: Computed from Table 32.

rice per acre the net income estimated from the chart would be 44,625-24,480 or 20,145 the same amount shown in Table 32.

With a price of $3.00 per hundredweight total costs would exceed total receipts and net farm income would be negative at yields below approximately 3,150 pounds per acre or 2,620 pounds per acre with the higher or lower cost schedules respectively. The intersections of the cost lines and the price lines represent break even points in the sense that with these yields and prices costs and depreciation would be covered but nothing would remain to compensate the operator for his interest on his investment, labor or management.

The estimated net returns from production of rice on 300 acres with variations in price received and in yield are shown in Figure 2. The readings in dollars on the lefthand scale of this chart are equivalent to the distances between the price lines and the total cost line, $TC_a$ and $TC_b$, shown in Figure 1. The variations in net income shown in Figure 2 may be demonstrated as follows:

| | | Total Net Income | |
|---|---|---|---|
| | | Price of | Price of |
| Yield of 2500 per acre | | $ 4.25 | $ 3.50 |
| cost curve | $TC_a$ | 8,300 | 2,700 |
| " " | $TC_b$ | 4,100 | -1,500 |
| " " 3500 | $TC_a$ | 20,100 | 12,200 |
| | $TC_b$ | 12,200 | 8,000 |

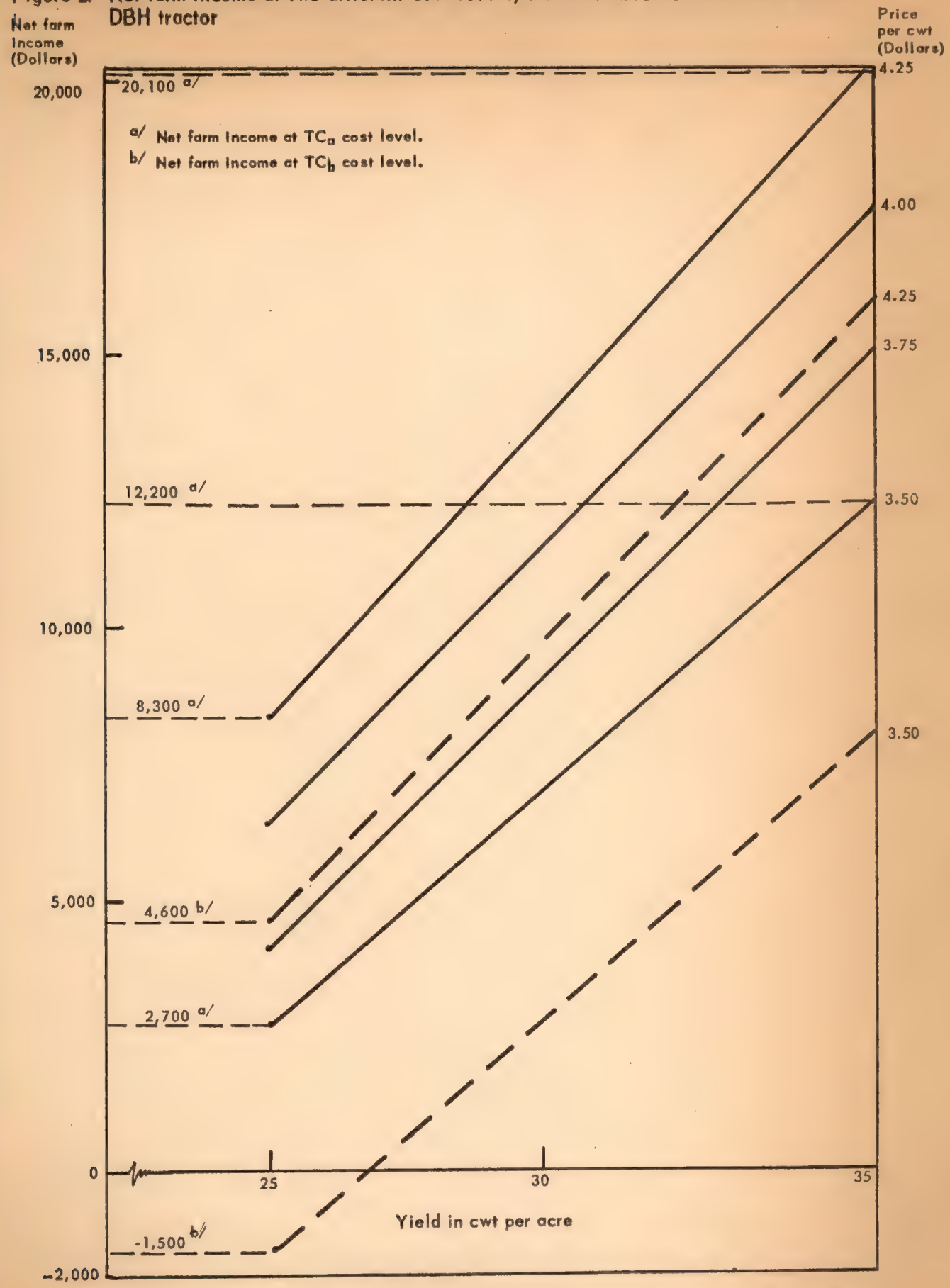
These lines are straight because it is assumed that this farmer is operating within that range where he is not over taxing his equipment or other facilities. He is able to earn as much above variable costs with any 1 acre of rice as with the prededing one. Net income from 300 acres of rice for two levels of costs can be read directly from the figure.

For any of the synthetic organizations that have been budgeted, net farm income for any given yield can be computed as follows:

Acres of rice (price per hundredweight x yield per acre) - acres of rice [cost per acre from Table 30- 32¢ ( 35 hundredweight-yield per acre)]

At a price of $4.25 and a yield of 25 cwt. per acre, net income would be as follows:
300 ($4.25 x 25) -300 [$81.60 - 32¢ (35-25)] = $8,355

Figure 2. Net farm income at two different cost levels; farm with 200 acres of rice and a 65 DBH tractor




Changes in yields, prices, and costs all have important effects on net farm incomes.

Source: Computed from Table 32.

BARLEY AND RICE ARE COMMONLY PRODUCED ON THE SAME FARM

Cropping histories discussed above showed that barley is the alternative crop most likely to be grown on the same farm with rice. This might be accomplished by reducing rice acreage and growing barley on the same fields or by maintaining the same rice acreage and cropping sequence with fallow while growing barley on additional cropland.

Requirements for Barley Production.--Typical inputs and costs will be developed for a farm with 450 acres of cropland that has 300 acres of rice on a rice-rice-fallow system. If the entire acreage of cropland were used for barley under continuous cropping with no fallow this farm could produce barley on 450 acres every year.

The major differences then between rice and barley production would result from the fact that barley is not irrigated and the entire acreage could be devoted to barley every year with no summer fallow. Except for the equipment used in the preparation of land for irrigation of rice, the same machinery is used for the two crops. Elimination of the ditcher, land plane, dozer and checker from the inventory of required equipment is probable because irrigation is not required. The bank out wagons may be eliminated because barley harvest is accomplished during the dry season and trucks can drive into the fields to receive the grain directly from the harvesters. This reduced inventory of equipment would have an average investment of $21,785 compared with $24,249 for the 300 acres of rice and 150 acres of summer fallow. A further reduction might be accomplished by replacing one of the self-propelled combines with a pull-type machine.

Timing of Inputs.--Preparation of the seedbed for barley would be done in the summer and early fall prior to the start of rice harvest. Seeding would be done in October or November after rice harvest for fall sown barley, or in April or May for spring sown barley.

TABLE 33

Variable Costs for Producing 450 Acres of Barley, Using a 65 Drawbar Horsepower Tractor as the Principal Source of Power a/

| Tractor b/ | Operation: Equipment | Operation: Size | Rate per 10 hour day c/ | Total hours | Cost per hour: Tractor | Cost per hour: Equipment d/ | Total Variable cost |
|---|---|---|---|---|---|---|---|
| | | | acres | | | dollars | |
| T-7 | Disk | 20' | 45 | 100 | 1.32 | .07 | 139 |
| T-7 | Plow | 10/14' | 25 | 180 | 1.32 | .11 | 257 |
| T-7 | Disk | 20' | 45 | 100 | 1.32 | .07 | 139 |
| T-3 | Harrow | 30' | 80 | 56 | .96 | .04 | 56 |
| T-3 | B-cast | | | 90 power | | | |
| | Seeder | -- | 50 | 180 man | .96 | -- | 86 |
| T-3 | Harrow | 30' | 80 | 56 | .96 | .04 | 56 |
| | Harvest S.P. | 14' header | 20 | 225 | -- | 2.24 | 504 |
| | Hauling | 1½ ton truck | 20 | 225 | -- | -- | -- |
| Variable machinery costs (other than trucks) | | | | | | | 1,237 |
| Variable costs of operating trucks e/ | | | | | | | 264 |
| Seed | | | | | | | 1,350 |
| Hired labor (90 hours seeding, 225 hours hauling) | | | | | | | 428 |
| Total variable costs | | | | | | | 3,279 |

a/ Operator is assumed to perform all the labor except for one man to help 90 hours with broadcast seeding, and one truck driver at harvest time. Only labor applied directly to the crop is listed here. The operator would put in much more time readying and repariing machinery, etc.

b/ Only crawler tractors are assumed. Some operators would use a wheel tractor instead of the T-3. Details of tractor costs are shown in Table 24.

c/ Based on rates obtained from farm interviews.

d/ Based on budget data developed from farm interviews.

e/ Assumes an annual mileage of 7,500 for the pickup, and 2,500 for the larger truck. Costs of operating trucks are based on data in Table 25.

TABLE 34

Farm Cost Summary and Per Acre Costs for 450 Acres of Barley; Per Acre Costs for 300 Acres of Rice

| Item | 450 acres of barley | | Per acre of barley | Per acre of rice |
|---|---|---|---|---|
| | Fixed | variable | | |
| Land | | | | |
| Real estate | $ 653 | -- | $ 1.45 | $ 2.18 |
| Improvements | 206 | -- | .46 | .69 |
| Labor | -- | 428 | .95 | 4.06 |
| Other | | | | |
| Tractors | 570 | 694 | 2.81 | 5.60 |
| Trucks | 1,015 | 264 | 2.84 | 6.99 |
| Machinery | 1,922 | 543 | 5.47 | 14.86 |
| Irrigation | -- | -- | -- | 9.85 |
| Materials | -- | 1,350 | 3.00 | 18.70 |
| Int. on production credit | -- | -- | -- | 1.14 |
| Custom charges | -- | -- | -- | 15.49 |
| Personal prop. tax | 179 | -- | .40 | 1.05 |
| Miscellaneous | -- | -- | -- | 1.00 |
| Total | $4,545 | $3,279 | | |
| Total fixed & variable costs | | 7,824 | 17.38 | 81.60 |
| Less depreciation | | 2,762 | 6.13 | 14.42 |
| Total cash costs | | $5,062 | $11.25 | $67.18 |

Inputs and variable costs.--The practices used, rates of performance, hours required and variable costs of producing barley under these conditions are presented in Table 33. Seed is the greatest single cost, at $1,350, followed by the costs of machinery operation, $1,237. Hired labor is much less important than on a rice farm, since the operator can perform all of the labor except at seeding and harvest time.

The classification of fixed and variable costs, and a comparison of rice and barley costs are shown in Table 34.

Comparison with rice costs.--The total cost per acre of producing a barley crop, $17.38, equals only 21 percent of approximately one-fifth of the cost of producing a rice crop. Another important difference lies in the relative proportion of fixed and variable costs. For barley production, fixed costs account for 58% of the total costs with only 42% variable. For rice production on this same acreage according to data in Table 29, only 29 percent of the costs are fixed, or unvarying with output.

This smaller cash outlay per acre for barley, both absolutely and relatively, is further illustrated by the comparison of total cash costs--costs other than depreciation which latter is a bookkeeping cost not involving a cash outlay in a particular year. The total cash cost per acre of barley is $11.25. The cash cost per acre for rice on a farm of comparable acreage using a rice-rice-fallow sequence would be $67.18 - more than five times as great. Production of rice rather than barley, therefore, required risking more money per acre, but perhaps even more important, it requires the producer to obtain more capital for use in growing rice.

Growing barley on additional land.--Before comparing incomes from rice and barley production, two other production situations should be considered. Many rice growers interviewed were attempting to obtain more land in order to increase acreage devoted to barley production, without having to reduce rice acreage. Two alternatives for a farm with 450 acres of cropland have been presented -

(1) 300 acres of rice with 150 acres of summer fallow and (2) 450 acres of barley.

The rice grower who succeeds in obtaining more cropland for barley production may be in one of two situations. First, the added cropland may be used for nothing but barley with the rice-rice-fallow sequence continuing on 450 acres. Or the new land may be integrated into the cropping system so that a sequence of rice-rice-fallow-barley will be used on both the new and original fields.

Additional land used for barley only.--Where additional cropland is used for barley only, the calendar of operations on the rice and summer fallow fields will not be changed. The only competition for the operator's labor will come at barley harvest time. No change in the inventory of equipment will be needed. One of the major advantages to the business will come from using the same equipment to operate an additional 150 acres of cropland. Inputs per acre will be identical with those where 450 acres of barley are grown. Variable costs therefore should be equal to one-third of those in Table 33, or $1,093. Fixed costs will change by the amount of taxes on the additional 150 acres of cropland. Assuming an assessed valuation of $33 per acre and tax rate of $4.00 per $100 of assessed value, this would mean an added $198.

Additional land used for rice and barley.--When the additional land can be used for rice, and the cropping sequence becomes rice-rice-fallow-barley, the greatest advantage results. Not only do the two crops supplement each other by making more use of the same inventory of equipment, but the summer fallow operations following the rice crop partially prepare the seedbed for barley. The addition of another 150 acres of cropland to the 450 adds 150 of barley harvest in the summer and 150 acres of barley seeding in the early winter to the rice and fallow operations.

The calendar of operations for the rice-fallow organization, Table 16, page 52, showed that the field to be fallowed received the following operations:

Knocking checks

Plowing

Disking

Land planing

Chiseling

To complete preparation of a seedbed after these operations, one disking following the first fall rains should be sufficient. This disking, plus seeding and harrowing, would be the only work necessary to seed barley on summer fallow ground.

Using the input rates from Table 33 for 450 acres of barley, the following inputs and variable costs would be required:

| | | |
|---|---|---|
| Disk with T-7 | 34 hours @ $1.39 | $47.26 |
| B-cast seeder with T-3 | 30 hours @ .96 | 28.80 |
| Harrow with T-3 | 19 hours @ 1.00 | 19.00 |
| Harvester | 75 hours @ 2.24 | 168.00 |
| Trucks | 75 hours @ 1.17 | 87.75 |
| | | $350.81 |

To this would be added seed at a cost of $450 and $143 for hired labor making a total cash outlay of $943.81 incurred in the production of barley on the additional 150 acres in rotation with rice.

Income From Barley Production Is Much Lower Than Income From Rice Production

Yields.-- Barley grown in rotation with rice might benefit from fertilizer applied to rice. In some cases, soils used for production of rice were more productive than the nonirrigated land used for production of only barley or other nonirrigated crops. This was not universally true because some fields used for rice production were so water-logged in the winter time that yields of barley were reduced to zero. In view of those variations a yield of 15 cwt. per acre will be used in determining net income from barley in each of the cropping situations.

Price.--A price of $2.25 per hundredweight of barley or $45 per ton will be used in initial calculations of grossincome.

Net income.--Comparison of net farm incomes from 450 acres of barley or from 300 acres of rice and 150 acres of barley are shown in Table 35. Net income from 150 acres of barley - $3,772 or $3,921 - in addition to 300 acres of rice, is more than one-half the net income earned by planting the entire 450 acres to barley. This illustrates the advantage to be gained by obtaining additional land to make better use of the equipment necessary for production of rice.

The difference between the two barley-rice combinations $3,921-3,772, or $149, represents the advantage to the barley enterprise of using some of the summer fallow operations to reduce barley seedbed preparation. This difference is not great relative to the total income because the more expensive summer fallow operations are charged to the rice enterprise in either case and because only tractor and machinery costs are included. It is assumed that the operator's unpaid labor will be able to perform the summer work. Seeding barley into summer fallow ground would save the operator 112 hours of tractor driving labor valued at $140 if hired.

TABLE 35

Net Farm Incomes from 450 Acres of Barley, and from 300 Acres of Rice Plus 150 Acres of Barley

| Item | 450 acres of barley | 300 acres a/ rice plus 150 barley | 300 acres b/ rice plus 150 barley |
|---|---|---|---|
| Income from barley | | | |
| Gross income | $15,118 | $ 5,063 | $ 5,063 |
| Fixed costs | 4,545 | 198 | 198 |
| Variable costs | 3,279 | 1,093 | 944 |
| Net Income | 7,364 | 3,772 | 3,921 |
| Income from rice, net | -- | 20,143 | 20,143 |
| Net farm income Rice plus barley | $ 7,364 | $ 23,915 | $24,064 |

a/ When the 150 acres of additional cropland is used for barley only.

b/ When the 150 acres of additional cropland is suitable for rice production and barley is seeded following fallow operations in a rice-rice-fallow-barley cropping system.

Use of the Additional Cropland for Rice is a More Profitable Alternative When Excess Machinery Capacity and Average Allotments Will Permit it.

The greater net return per acre from rice than from barley leads to the question whether an additional 150 acres of cropland should be used for barley or for enlarging the rice enterprise.[1/] Whether this question could be entertained would depend on the availability of equipment or existence of excess equipment in the inventory. For the inventory of equipment built around a T-5 or 45 horsepower tractor, as used above, additional rice acreage would not be practicable without obtaining additional tractor power. On the other hand the T-7 tractor on 300 acres of rice, as described above, would be adequate to handle the expansion of rice acreage.

A comparison of net farm incomes from 300 acres of rice and 150 acres each of barley and summer fallow, with 400 acres of rice and 200 of summer fallow appears in Table 36. By producing rice on an additional 100 acres, and fallowing an additional 50 to maintain the rice-rice-fallow system, net income could be increased by $4,739 beyond the rice-barley income of $24,064. To achieve this greater income, variable costs would be increased by $4,783 and fixed costs by $198. This represents an added return of $1.95 and an increase in net income of 95¢ for every $1 risked in increased costs.

The greatest risk would be from reduced yields on the added 100 acres of rice:

35 hundredweight (150 acres) = 5,250 hundredweight

Every hundredweight less than this amount would reduce net income by $4.25 - drying charge of 32¢ = $3.93. The increased income of $4,739 would therefore be equal to $4,739 ÷ $3.93 or 1,205 hundredweight of rice. This quantity divided by 100 acres equals 12 hundredweight per acre on the additional acreage, the drop that would eliminate the advantage in growing rice rather than barley.

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1/ Under present conditions this question is unlikely to arise because of restrictions on rice acreage. It was a pertinent question however during the period of this study and will be examined briefly here. The substitution between rice and barley under acreage allotments will be examined in a later publication in this series.

TABLE 36

Net Farm Incomes From 300 Acres of Rice, 150 Barley, and 150 Summer Fallow, and From 400 Acres of Rice With 200 Summer Fallow

| Item | 300 acres rice 150 acres barley 150 acres summer fallow | | 400 acres rice 200 acres summer fallow | |
|---|---|---|---|---|
| | Dollars | | | |
| Gross receipts from rice a/ | 44,625 | | 59,500 | |
| Gross receipts from barley b/ | 5,063 | | | |
| Total receipts | | 49,688 | | 59,500 |
| Variable costs rice | 17,355 | | 23,082 | |
| Variable costs barley | 944 | | | |
| Total variable costs | 18,299 | | 23,082 | |
| Fixed costs rice | 7,127 | | 7,615 | |
| Fixed costs barley | 198 | | | |
| Total fixed costs | 7,325 | | 7,615 | |
| Total costs c/ | | 25,624 | | 30,697 |
| Net farm income | | 24,064 | | 28,803 |

a/ Rice yield of 3,500 pounds per acre is used with an average sale price of $4.25 per hundredweight.

b/ Barley yield of 1,500 pounds per acre is used with an average sale price of $2.25 per hundredweight.

c/ Summer fallow costs are included in rice costs.

Source: Computed from farm interview data.

Again, 1,205 cwt. ÷ 400 acres = 3 hundredweight per acre of rice, the drop in yield on entire acreage that would eliminate the advantage in growing rice rather than barley on the added cropland. This yield decline might occur if an inventory of equipment adequate to operate 300 acres of rice and 150 acres of barley proved inadequate to operate 400 acres of rice.

## SUMMARY AND CONCLUSIONS

Farmers in the Sacramento Valley have combined poorly drained soils, an abundance of low cost water for irrigation, flat terrain, and a favorable climate in developing a highly mechanized rice culture.

Restricted on poor drainage, winter flooding, or concentrations of salts and alkali, limit the use of large acreages in the valley to crops that can withstand such conditions. Rice which grows during the summer heat and must be grown in submerged fields can tolerate these soil characteristics that would be serious defects for other crops.

The California rice industry is based on varieties adapted from short-grain types originating in Japan. Long-grain types do not yield as well with the summer temperature conditions found in the Sacramento Valley. Use of the short-grain varieties tends to limit the outlets for California rice in the domestic market and in those overseas markets that prefer other types.

Heavy rains that delay seed bed preparation in March and April or interfere with harvesting in October and November greatly increase the risk of abnormally high costs on below average yields. Varieties and cultural practices developed at the Biggs Rice Field Station permit grounds to adjust to these conditions.

Production costs are sometimes increased to as much as one third above normal by treatment required to combat serious infestations of weeds, insects, or migratory water fowl.

The heavy investment in machinery and annual operating costs required in rice production has tended to encourage a high rate of tenancy in the area. In the five principal rice growing counties in 1950 - Butte, Colusa, Glenn, Sutter, and Yolo - only 33 per cent of the growers of rice limited their operations to owned land. By comparison, 49 percent were producing all of their rice on leased land. The owner-operators averaged 221 acres of rice; tenant operations averaged 260 acres of rice; growers who produced rice on both owned and leased land averaged 470 acres.

With few exceptions, leases were based on crop-share rental; this divides the risk of yield and price fluctuations between landlord and tenant.

Prices received for rice and other principal crops in the area jumped sharply after 1945. The price of rice has tended to be higher in relation to 1945 than those other crops since that date. Since 1933 all of the major field crops in the rice growing area have been affected by Federal laws dealing with the support of commodity prices, acreage allotments, subsidy payments, and production goals.

Price support programs have tended to increase output of the crops supported. Acreage allotments in 1950 and since 1955 have decreased acreages of rice.

Of the 49 farms studied in Colusa County, 20 percent grew no crop other than rice. Forty-three percent grew rice and one or more of the other small grains - with barley predominating in a rice-rice-idle-barley sequence. Twenty-nine per cent grew rice and another grain plus a third crop-usually a legume forage crop.

Some fields were used for rice exclusively. Other fields on the farm were used for other crops, if any were grown. Fifty percent of the fields used for rice on survey farms in Colusa County in 1950 had been used for no crop other than rice during the period 1947-1950.

In Sutter County only 28 percent of the fields had been used for rice only during this period. Wheat instead of barley was the principal alternative among the other cereals. A rotation of rice-wheat-beans was being followed on 21 percent of the Sutter County fields studied.

Fields that had been in rice for atleast four years received an average application of 60 pounds of Nitrogen per acre. Yields ranged from 2,531 to 4,916 pounds per planted acre with an average of 3,896 pounds.

In Sutter County where legumes were used in the rotation or as green manure, yields of from 3,500 to 6,800 pounds were obtained without the use of commercial nitrogen fertilizers applied to the rice crop.

Livestock enterprises have not been common on Sacramento Valley rice farms. In 1950, owned livestock appeared on only 18 percent of the survey farms in Colusa County. Another 22 percent rented pasture to livestock men.

Acreage of rice per farm varied greatly. On the 681 farms that grew rice in the five counties in 1950 there were 50 that had less than 40 acres of rice and 34 that had over 800 acres. In the over-all distribution of rice acreage on these farms there were significant concentrations between: 40 to 80 acres; 120 to 160 acres; and 360 to 640 acres. There were significant differences in the organization of typical farms within these different groups.

For purposes of comparison input-output data and machinery requirements are shown for farms typical of those with 150, 300, 450 and 600 acres of rice when following a rice-rice-fallow cropping sequence on rice fields.

Based on items found on farms in 1950 and 1953, the estimated average investment in tractors and machinery on these farms is as follows:

| Acres of rice planted | Investment |
|---|---|
| 150 | 10,900 |
| 300 | 20,450 |
| 450 | 25,000 |
| 600 | 36,300 |

These investments represent the summation of the average investment over the life of the individual items, using prices being paid from 1950-1953. A farm having all new equipment would have at least twice these investments while one with older equipment or major items purchased used would have less invested.

The cultural practices performed on farms with different rice acreages were essentially the same. There were differences in the amount of services hired. Differences in operations were more closely correlated with the size of the principal tractor used on the farm than with rice acreage.

Operators with more than 450 acres of rice tend to use more harvest equipment owned or hired to shorten the harvest season. On the smaller acreages the operators tried to finish their harvest without being forced to hire additional equipment and men.

With the equipment being used on typical farms, labor inputs per acre were as follows:

| Acres of rice | Man hours per acre |
|---|---|
| 150 with a 45 H.P. Tractor | 8.62 |
| 300 with a 45 H.P. Tractor | 7.87 |
| 300 with a 65 H.P. Tractor | 7.36 |
| 450 with a 65 H.P. Tractor | 7.37 |
| 600 acres with a 5 & 45 H.P. Tractors | 7.03 |

The tractlaying tractors and self-propelled combines, especially adapted for traversing the muddy fields were the principal equipment investment items. By 1950, a high percentage of the rice was handled entirely in bulk rather than in sacks and was artificially dried. The trend toward this type of handling has continued.

Estimated costs of producing rice, exclusive of interest on investment and the operator's labor, ranged from $2.21 to $2.57 per hundredweight approximately 30 percent of those costs were fixed costs.

Variations in weather and the increase of insect and weed pests and inter-farm differences in soil characteristics can increase costs for individual farms as much as 50 percent above "typical" in years of adverse conditions.

Because of the tendency to hire a higher proportion of the labor, net farm incomes for the larger farms budgeted did not increase in proportion to increase in rice acreage.

Barley, the most widely grown alternative to rice, could be expected to return approximately one-third as much net-income as rice with barley selling at $2.25 and rice at $4.25 per hundredweight.

APPENDIX

**TABLE 1**

Soil Types, Area, Preceding Crops, Nitrogen Applied, and Rice Yield Per Acre in 1950 for 53 Colusa County Fields

| Soil type[a] | Area of Field | Preceding crops | | | Rice in 1950 | |
|---|---|---|---|---|---|---|
| | | 1947 | 1948 | 1949 | Nitrogen per acre | Yield per acre |
| | Acres | | | | Pounds [b] | Pounds [c] |
| Willows clay slightly alkaline | 39 | Rice | Rice | Rice | 84 | 4,916 |
| | 165 | Clover | Clover | Rice | 0 | 4,711 |
| | 84 | Barley | Barley | Rice | 0 | 4,085 |
| | 55 | Pasture | Pasture | Pasture | 0 | 4,000 |
| | 80 | Rice | Rice | Rice | 68 | 3,875 |
| | 126 | Pasture | Barley | Rice | d/ | 3,400 |
| | 145 | Barley | Barley | Rice | 63 | 3,394 |
| | 60 | Fallow | Barley | Barley | 0 | 2,500 e/ |
| | 90 | Fallow | Barley | Barley | 0 | 2,200 e/ |
| Willows clay moderately alkaline | 46 | Rice | Pasture | Pasture | 42 | 5,448 |
| | 169 | Fallow | Rice | Fallow | d/ | 4,700 |
| | 80 | Rice | Rice | Rice | 84 | 4,200 |
| | 80 | Rice<br>Rice | Rice<br>Rice | Wheat<br>Fallow | 63 | 4,185 |
| | 279 | Barley | Rice | Fallow | 38 | 4,010 |
| | 152 | Rice | Fallow | Rice | 75 | 4,000 |
| | 149 | Rice | Rice | Rice | d/ | 3,760 |
| | 200 | -- | Idle | Wheat | 63 | 3,750 |
| | 53 | Pasture | Pasture | Pasture | d/ | 3,300 |
| | 30 | Rice | Rice | Idle | d/ | 3,300 |
| | 12 | Rice | Idle | Idle | d/ | 3,300 |
| | 278 | Fallow | Rice | Fallow | 42 | 3,129 |
| | 180 | Rice | Fallow | Rice | 63 | 3,040 |
| | 338 | Rice | Fallow | Rice | d/ | 2,900 |
| | 94 | Pasture | Pasture | Fallow | 0 | 2,845 |
| | 263 | -- | -- | -- | 42 | 2,800 |
| Willows clay strongly alkaline | 252 | Barley | Barley | Rice | 42 | 3,925 |
| | 200 | Rice | Fallow | Rice | 49 | 2,531 |
| | 78 | Rice | Rice | Rice | | |
| | 311 | Idle | Barley | Barley | 19 | 2,500 |
| Marvin Clay Loam | 16 | Clover | Clover | Clover | 0 | 7,315 |
| Marvin Silty Clay Loam | 180 | Rice | Fallow | Barley | 0 | 3,500 |
| Marvin Clay | 324 | -- | -- | Rice | 0 | 3,544 |

Table 1 --continued--

Table 1 - Continued.

| Soil type a/ | Area of Field | Preceding crops 1947 | 1948 | 1949 | Rice in 1950 Nitrogen Per acre | Yield per acre |
|---|---|---|---|---|---|---|
| | Acres | | | | Dollars b/ | Dollars c/ |
| Marvin clay slightly alkaline | 110 | Rice | Barley | Idle | 0 | 5,800 |
| | 35 | -- | -- | Rice | 49 | 5,428 |
| | 200 | Rice | Rice | Fallow | 0 | 3,896 |
| | 102 | -- | -- | Rice | 49 | 3,823 |
| | 63 | -- | Fallow | Rice | 40 | 3,500 |
| | 72 | Rice | Idle | Rice | 42 | 3,492 |
| | 348 | Rice | Fallow | Fallow | 0 | 3,184 |
| | 290 | Rice | Barley | Idle | 0 | 2,700 g/ |
| | 20 | -- | -- | Rice | 49 | 2,500 |
| Sacramento clay | 145 | Rice | Peas | Rice | 42 | 4,000 |
| | 450 | Fallow | Barley | Barley | 25 | 4,000 |
| | 220 | Rice | Milo | Barley | 42 | 3,450 |
| | 450 | -- | -- | -- | f/ | 3,200 |
| | 290 | Fallow | Barley | Rice | 42 | 2,748 |
| Hillgate clay loam | 80 | Rice | Fall | Rice | 69 | 5,000 |
| | 126 | Rice | Rice | Rice ) | d/ | 3,100 |
| | 60 | Rice | Rice | Fall ) | d/ | |
| | 75 | Wheat | Wheat | Wheat ) | 20-21 | |
| Genevra clay | 60 | Fallow | Fallow | Rice | 69 | 5,000 |
| | 120 | Rice | Fallow | Rice | 66 | 5,000 |
| Myers clay | 30 | Rice | Rice | Rice | 53 | 3,667 |

a/ A field was classed as a single soil type if 85% or more was of one type. In many cases field boundaries were coincident with natural boundaries which also divided soil types.

b/ Figure given is total pounds of actual nitrogen.

c/ Pounds of dry paddy rice.

d/ Amount of fertilizer applied in 1950 not known.

e/ Yields in these fields were affected by late seeding and difficulty with irrigation. Some seeded acreage was abandoned.

f/ 150# on 180 acres. 300# on 270 acres.

g/ This piece suffered from improper irrigation. The balance of the field yielded 5,800.

Source: Data collected in interviews with rice growers.

TABLE 2

Field Area Preceding Crops, Nitrogen Applied on Green Manure Crop, and Rice Yield Per Acre in 1950 for 18 Sutter County Fields

| | Area of Field | Preceding Crops | | | Rice in 1950 | | |
|---|---|---|---|---|---|---|---|
| | | 1947 | 1948 | 1949 | Nitrogen per acre | Green Manure crop | Yield |
| | Acres | | | | Dollars b/ | | Dollars c/ |
| On farms in the Sutter Basin area a/ | 156 | Beans | Beans | Wheat | 0 | Yes | 6,100 |
| | 145 | Beans | Beans | Wheat | 0 | Yes | 6,100 |
| | 141 | Wheat | Rice | Wheat | 0 | Yes | 6,020 |
| | 154 | Rice | Beans | Wheat | 0 | Yes | 5,000 |
| | 150 | Wheat | Wheat | Beans | 38 | No | 4,800 |
| | 140 | Wheat | Wheat | Wheat | 0 | Yes | 4,800 |
| | 134 | Peas | Rice | Peas | 0 | No | 4,300 |
| | 147 | Rice | Beans | Wheat | 0 | No | 3,500 |
| | 160 | Rice | Beans | Barley | 30 | Yes | 2,300 |
| On farms not in the Sutter Basin areas | 75 | O&V | O&V | O&V | 0 | Yes | 6,800 |
| | 46 | Idle | Rice | Idle | 0 | No | 5,000 |
| | 134 | Rice | Rice | Rice | 31 | No | 4,907 |
| | 120 | Rice | Rice | Rice | 53 | No | 4,549 |
| | 20 | Pasture | Pasture | Pasture | 0 | No | 4,284 e/ |
| | 60 | Rice | Rice | Rice | 63 | No | 4,063 |
| | 160 | Idle | Rice | Idle | 0 | No | 3,500 f/ |
| | 62 | -- | Rice | Rice | d/ | No | 2,813 |
| | 80 | Fallow | Rice | Rice | 0 | Yes | 2,287 g/ |

a/ An area rather than a soil type distinction is used in this county. The soil types would not be fully comparable with those for Colusa County becaus of the 35 years intervening between soil surveys available for the two counties.

b/ Figure given is total pounds of actual nitrogen.

c/ Pounds of dry paddy rice.

d/ Amount of fertilizer applied in 1950 not known.

e/ Approximately one-half of this 20 acres blanked out and produced no rice. The 10 acres that were dried up and mowed in mid-summer then reflooded yielded over 80 hundredweight per acre.

f/ The first 46 acres harvested yielded 5,000# per acre. After a heavy wind storm, the entire field averaged only 3,500# per acre.

g/ This field did not yield well because of improper irrigation during the summer.

Source: Data collected in interviews with rice growers.

[illegible]

TABLE 3

Estimated Costs Per Acre for Producing 300 Acres of Rice; Owner-operator with a Complete Inventory of Owned Equipment a/

| Operation, Crew, and Equipment | Hours per acre | Cash costs per acre: Labor | Tractor and equip. | Contract | Materials | Total cash cost | Depr. on equip. | Total Cost per acre |
|---|---|---|---|---|---|---|---|---|
| | | Dollars | | | | | | |
| Cultural costs | | | | | | | | |
| Plow: man, tractor, 10-14" plow | .56 | .70 | .90 | | | 1.60 | .62 | 2.22 |
| Disk: man, tractor, 20' disk | .13 | .16 | .24 | | | .40 | .20 | .60 |
| Float: man, tractor, 12' x 30' float | .22 | .28 | .31 | | | .59 | .15 | .74 |
| Survey: custom | | | | .50 | | .50 | | .50 |
| Plow contours: man, tractor, 4/14" plow | .03 | .04 | .05 | | | .09 | .00 | .09 |
| Plow checks: man, tractor, 10/14" plow | .05 | .06 | .08 | | | .14 | .06 | .20 |
| Check:man, tractor (1 man, tractor hired) | .03 | .04 | .14 | .23 | | .41 | .18 | .59 |
| Plow borrow pits:man,tractor 10-14" plow | .03 | .04 | .05 | | | .09 | .03 | .12 |
| Disk and harrow:man,tractor,disk and harrow | .27 | .34 | .56 | | | .90 | .44 | 1.34 |
| Repair checks:man,tractor, ditcher | .03 | .04 | .05 | | | .09 | .04 | .13 |
| Place boxes: man, tractor, dozer | .02 | .02 | .03 | | | .05 | .02 | .07 |
| Close checks: man, tractor, dozer | .07 | .09 | .10 | | | .19 | .06 | .25 |
| Fertilize. plane and truck | .08 | .12 | .03 | 2.13 | 7.50 b/ | 9.78 | .14 | 9.92 |
| Flood | .50 | .50 | | | | .50 | | .50 |
| Seed: plane, man | .10 | .10 | | 1.60 | 11.20 c/ | 12.90 | | 12.90 |
| Irrigate | 1.93 | 1.93 | | | 8.50 d/ | 10.43 | | 10.43 |
| Drain and open checks | .10 | .12 | .15 | | | .27 | .08 | .35 |
| Bird control: man and plane | | | | 1.00 | | 1.00 | | 1.00 |
| Total cultural cost | | 4.58 | 2.69 | 5.46 | 27.20 | 39.93 | 2.02 | 41.95 |
| Harvest costs | | | | | | | | |
| Combine: 2 men, 2 self-propelled | .44 | 1.10 | 2.94 | | | 4.04 | 6.54 | 10.58 |
| Bankout: man, tractor, bankout wagon | .44 | .66 | .94 | | | 1.60 | .83 | 2.43 |
| Haul to mill, 1½ ton truck (2) | .89 | 1.34 | .71 | | | 2.05 | | |
| Dry: at 30 cents wet weight | | | | 11.29 | | 11.29 | | 11.29 |
| Total harvest cost | | 3.10 | 4.59 | 11.29 | | 18.98 | 7.37 | 24.30 |

Table 3 --continued--

Table 3 - Continued.

| Operation, Crew, and Equipment | Hours per acres | Cash Costs per acre: Labor | Tractor and equip. | Contract | Materials | Total cash cost | Depr. on equip. | Total Cost per acre |
|---|---|---|---|---|---|---|---|---|
| | | Dollars | | | | | | |
| Summer fallow costs | | | | | | | | |
| Knock check, man, tractor, 10-14" plow | .33 | .41 | .53 | | | .94 | .37 | 1.31 |
| Disk: man, tractor, 20' disk | .11 | .14 | .20 | | | .34 | .17 | .51 |
| Chisel: man, tractor, 10' chisel | .22 | .28 | .50 | | | .78 | .41 | 1.19 |
| Landplane: man, tractor, 12' plane | .25 | .31 | .49 | | | .80 | .52 | 1.32 |
| Total summer fallow cost | | 1.14 | 1.72 | | | 2.86 | 1.47 | 4.33 |
| Total | | 8.82 | 9.00 | 16.75 | 27.20 | 61.77 | | |
| Miscellaneous costs | | | | | | | | |
| Annual overhaul of harvesters 2 at $500 | | | | | | 3.33 | | |
| Real estate taxes | | | | | | 2.18 | | |
| Overhead on shop and shed | | | | | | .69 | | |
| Overhead on irrig. boxes and ditches | | | | | | 1.35 | | |
| Depreciation & taxes on shop equip., machinery carryall and grease wagon | | | | | | 1.01 | | |
| Overhead and operating costs of pickup | | | | | | 2.60 | | |
| Interest on borrowed operating capital | | | | | | 1.14 | | |
| Total miscellaneous | | | | | | 12.30 | | 12.30 |
| Total cost per acre | | | | | | 74.07 | | 87.99 e/ |
| Cost per hundredweight | | | | | | | | 2.51 |

a/ Based on a rice-rice-fallow cropping system, and a yield of 3,500 weight of dry paddy rice per acre, with a 65 drawbar horsepower tractor as the principal source of power.

b/ Cost of Ammonium Sulfate--200 pounds per acre applied on 150 acres of rice following summer fallow and 300 pounds per acre on 150 acres of rice following rice at a price per ton of $60.00

c/ Cost of 160 pounds of seed per acre on 300 acres--at a price for seed of $7.00 per hundredweight.

d/ Cost per acre of water

e/ These costs cover all the labor. The cost per acre shown in table 29, page 93 does not include the value of the operator's labor at $6.04 per acre.

TABLE 4

Farm Budget Summary Worksheet; Fixed and Variable Costs, 150 Acres of Rice With 75 Acres of Summer Fallow a/

| Item | Computation | Dollars | Costs Fixed Dollars | Costs Variable Dollars |
|---|---|---|---|---|
| Labor | Harvest labor 134 hours at 1.50 | | | 201 |
| | Other seasonal 57 hours at 1.00 | | | 57 |
| | State Compensation Insurance 4% of gross wages | | | 10 |
| Materials | Seed 160 pounds per acre 150 acres at $7.00 cwt. | | | 1,680 |
| | Fertilizer 250 pounds per acre 150 acres at 3.00 cwt | | | 1,125 |
| Irrigation | Ditches (repair and replacement) 225 acres at .50 | | 112 | |
| | Water 150 acres at 8.50 | | | 1,275 |
| | Irrigation boxes (replacement) replace 1/3 of total boxes each year at $4.50 per box with .4 boxes per acre | | | 90 |
| Field Power | T-5 Annual fixed repairs | | 75 | |
| | Fuel 378 hours at .49 a/ | 185.22 | | |
| | Fuel 152 hours at .28 b/ | 42.56 | | |
| | | 227.78 | | 228 |
| | Fixed lubrication | | 16 | |
| | Variable lubrication 530 hours at $.06 | | | 32 |
| | Repairs 530 hours at .422 | | | 224 |
| | Depreciation | | 288 | |
| Pickup | Pickups | | | |
| | Taxes $50 and license $35 | | 85 | |
| | Fuel 10,000 miles at 12 miles per gallon x .26 per gallon | | | 217 |
| | Lubrication 10 lubs at $2.00 per lub | | | 20 |
| | Annual maintenance | | | 85 |
| | Depreciation d/ | | 400 | |
| Machinery | Harvester one self propelled | | | |
| | Repairs Fixed repairs | | 500 | |
| | Field repairs 13.4 days at 15.00 | | | 201 |
| | Fuel 107 hours at .65 | | | 70 |
| | Lubrication 107 hours at .19 | | 16 | 20 |
| | Depreciation d/ | | 788 | |
| | Other Machinery | | | |
| | Repairs on other machinery e/ | | | 120 |
| | Depreciation on other machinery d/ | | 462 | |
| | Taxes on machinery f/ | | | |
| | New Cost $16,725 x $\frac{70\%}{2}$ x $4.00 per $100 value x 66% | | 156 | |
| | 16,725 x .35 x .04 x .66 | | | |

Table 4 --continued--

Table 4 - Continued.

| Item | Computation | Dollars | Costs Fixed Dollars | Costs Variable Dollars |
|---|---|---|---|---|
| Improvements | Shed | | | |
| | Depreciation $1,800 value with 15 years life expectancy | | 120 | |
| | Tax 2% of value of building | | 36 | |
| | Repairs annual fixed cost | | 50 | |
| Interest on Operating Capital | Money borrowed every two weeks during the production period beginning March 14. Principal and interest paid November 15. | | | 166 |
| Taxes on Real Estate | Assessed value per acre = $33.00 Tax rate = $4.00 per every $100 of assessed value | | 327 | |
| | 225 acres cropland plus 10% for waste land and farmstead = 247.5 acres. 247.5 x 33 x .04 = $326.70 | | | |
| Duck Control | Average costs of $1.00 per acre | | | 150 |
| Custom and Rental | Seeding 160 pounds per acre at 1.00 cwt | | | 240 |
| | Fertilizing 250 pounds per acre at .85 per cwt | | | 319 |
| | Drying 5,645 cwt at .30 | | | 1,694 |
| | Hauling seed 12 ton at 2.00 | | | 24 |
| | Hauling Fertilizer 18.75 ton at 2.00 | | | 38 |
| | Haul rice to dryer 28.2 tons at 2.00 | | | 56 |
| | Checking T-7 checker and operator 10 hours at 10.00 | | | 100 |
| | Chiseling 34 hours at 3.50 hour | | | 119 |
| | Surveying 75 acres at .50 | | | 38 |
| | Rented T-7 (costs for fuel and repair) for chiseling | | | |
| | Fuel 34 hours at .63 | | | |
| | Repairs 34 hours at .633 | | | 22 |
| | Landplane Rental 60 hours at 1.00 | | | 60 |
| | Sub totals | | 3,431 | 8,702 |
| | Total Expenses g/ | | 12,133 | |

a/ Per hour and per acre rates used were derived from farm interview data. Input is summarized on Table 17, page 59.

b/ Heavy work.

c/ Light work.

d/ Source of depreciation figures for equipment shown on Table 14, page 43.

e/ Source of machinery repair figures shown on Appendix Table 8.

f/ New value of machinery figures shown on Table 14, page 43.

g/ Total expenses are for a rice production of 35 cwt. per acre (dry weight).

[illegible]

[illegible]

[illegible]

TABLE 5

Farm Budget Summary, 300 Acres Rice With
150 Acres Summer Fallow (Tractors Include T-5 and T-3) a/

| Item | Computation | Dollars | Cost Fixed | Cost Variable |
|---|---|---|---|---|
| | | | Dollars | |
| Labor | Harvest labor: 133 hours at 2.50 | 332.50 | | |
| | 399 hours at 1.50 | 598.50 | | |
| | | 931.00 | | 931 |
| | Other labor: 13 hours at 1.50 | 19.50 | | |
| | 166 hours at 1.25 | 207.50 | | |
| | 152 hours at 1.00 | 152.00 | | |
| | | 379.00 | | 379 |
| | State Compensation Insurance at 4% of gross wages paid | | | 52 |
| Materials | Seed-Rice 160 pounds per acre at 7.00 per cwt. | | | 3,360 |
| | Fertilizer 250 pounds per acre at 3.00 per cwt. | | | 2,250 |
| Irrigation | Ditches (repair and replacement) 450 acres at .50 | | 225 | |
| | Water 300 acres at 8.50 per acre | | | 2,550 |
| | Irrigation boxes (replacement) replace 1/3 of total boxes each year at 4.50 per box, with .4 boxes per acre | | | 180 |
| Field Power | Repairs | | | |
| | T-5-Fixed Annual repairs | | 75 | |
| | Fixed repairs, 797 hours at .422 | | | 334 |
| | T-3-Fixed annual repairs | | 50 | |
| | Fixed repairs-146 hours at .25 | | | 36 |
| | Field repairs on rented T-7 67 hours at .633 | | | 42 |
| | Fuel | | | |
| | T-5-626 hours (heavy) at .49 | 306.74 | | |
| | 166 hours (light) at .28 | 46.48 | | |
| | T-3-136 hours (heavy) at 1.04 | 141.44 | | |
| | 10 hours (light) at .78 | 7.80 | | |
| | T-7 (rented) 67 hours (heavy) at .63 | 42.21 | | |
| | | 544.67 | | 545 |
| | Lubrication | | | |
| | T-5-Fixed lub | | 16 | |
| | Variable lub-792 hours at .06 | | | 48 |
| | T-3-Fixed lub | | 5 | |
| | Variable lub-146 hours at .05 | | | 7 |
| | Depreciation b/ | | | |
| | T-5 (no depreciation on T-3) | | 288 | |

Table 5 --Continued--

Table 5 - Continued.

| Item | Computation | Cost Fixed | Cost Variable |
|---|---|---|---|
| | | Dollars | |
| Trucks | Two $1\frac{1}{2}$ ton-$90 license, $40 Insurance on each truck | 260 | |
| | Fuel and service-2,500 miles per each truck at 8 miles per gallon at .26 per gallon, plus 2.00 per 1,000 miles for servicing | | 172 |
| | Pickups-License $50, Insurance $35 | 85 | |
| | Fuel and service-12,500 miles at 12 miles per gallon at .26 per gallon, plus 2.00 per 1,000 miles for servicing. | | 295 |
| | Tires, batteries and miscellaneous-$85 | | 85 |
| | Depreciation b/ Trucks $400 each, pickup $400 | 1,200 | |
| Machinery | Harvesters (two) | | |
| | Fixed repairs-$500 each | 1,000 | |
| | Field repairs-26.6 days at $15 per day | | 399 |
| | Fuel-212 hours at .65 | | 138 |
| | Lubrication-212 hours at .19 | | 40 |
| | Depreciation b/ 787.50 each | 1,575 | |
| | Other machinery | | |
| | Repairs c/ for 300 acres with T-5, T-3, power | | 268 |
| | Depreciation b/ | 642 | |
| Taxes on Machinery | New Cost of Machinery d/ $28,790.00 | | |
| | Tax Formula | | |
| | $28,790 x $\frac{70\%}{2}$ x $4.00 per 100 of value x 2/3 | 269 | |
| Improvements | Shed | | |
| | Depreciation value of building $1,800 | | |
| | 15 years life expectancy | 120 | |
| | Tax = 2% of value of building | 36 | |
| | Maintenance-fixed yearly cost | 50 | |
| Interest on Operating Capital | Money obtained every two weeks to pay expenses for that period. Interest is at 6% for the time borrowed. Principal and interest are paid on Nov. 15. Money is borrowed from March 15 until the end of harvest. | | 335 |
| Taxes on Real Estate | Assessed value per acre = $33.00 | | |
| | Tax rate = $4.00 per every $100 assessed value | | |
| | 450 acres crop land plus 10% waste land = 495 acres. | 653 | |

Table 5 --Continued--

Table 5 - Continued.

| Item | Computation | Cost | |
|---|---|---|---|
| | | Fixed | Variable |
| | | Dollars | |
| Duck Control | Average cost of 1.00 per acre | | 300 |
| Custom and Rental | Seeding-160 pounds per acre at 1.00/cwt. | | 480 |
| | Fertilizing-250 pounds per acre at .85/cwt. | | 638 |
| | Checking-15 hours at $10.00 per hour | | 150 |
| | Chiseling hours at 3.50 per hour | | 234 |
| | Surveying-150 acres at .50 per acre | | 75 |
| | Drying | | 3,387 |
| Total | | 6,549 | 17,710 |
| Total Fixed and variable | | 24,259 | |

a/ Acre rates used were derived from farm interview data. Inputs are summarized on Table 18, page 62.

b/ Source of depreciation figures for equipment shown on Table 14, page 43.

c/ Machinery repair figures shown in Appendix table 8.

d/ New Value of equipment shown in Table 14, page 43.

TABLE 6

Farm Budget Summary Worksheet, Fixed and Variable Costs, 450 Acres Rice With 225 Acres of Summer Fallow a/

| Item | Computation | Dollars | Cost Fixed Dollars | Cost Variable Dollars |
|---|---|---|---|---|
| Labor | Harvest labor 800 hours at 1.50 | 1,200.00 | | |
| | Regular hired man 1 month | 350.00 | | |
| | | 1,550.00 | | 1,550 |
| | Other labor Hired man 3 months at 350 per month | | | 1,050 |
| | State Compensation Insurance at 4% of gross wages paid | | | 104 |
| Materials | Seed-Rice 160 pounds per acre at 7.00 cwt. | | | 5,040 |
| | Fertilizer 250 pounds per acre at 3.00 cwt. | | | 3,375 |
| Irrigation | Ditcher (repair and replacement) 675 acres at .75 | | 506 | |
| | Water 450 acres at 8.50 | | | 3,823 |
| | Irrigation boxes (replacement) .4 box per acre on 450 acres cost $4.50 per box average life 3 years | | | 270 |
| Field Power | Repairs | | | |
| | T-7 Fixed annual repairs | | 100 | |
| | Field repairs 1185 hours at .633 | | | 750 |
| | T-3 Fixed annual repairs | | 50 | |
| | Field repairs 246 hours at .25 | | | 62 |
| | Fuel | | | |
| | T-7 1025 hours heavy work at .63 b/ | 645.75 | | |
| | 160 hours light work at .49 c/ | 78.40 | | |
| | T-3 71 hours heavy work at 1.04 b/ | 73.84 | | |
| | 175 hours light work at .78 c/ | 136.50 | | |
| | Fixed lubrication charge | 934.49 | | 934 |
| | T-7 and T-3 | | 26 | |
| | Lubrication | | | |
| | T-7 1185 hours at .07 | 83.00 | | |
| | T-3 246 hours at .05 | 12.00 | | |
| | | 95.00 | | 95 |
| | Depreciation d/ | | | |
| | T-7 Fixed depreciation | 420.00 | | |
| | T-3 No depreciation | | | |
| | | 420.00 | 420 | |

Table 6 --Continued--

Table 6 - Continued.

| Item | Computation | Dollars | Cost Fixed (Dollars) | Cost Variable (Dollars) |
|---|---|---|---|---|
| Trucks and Pickup | Truck-License $90, Insurance $40 each truck | | 260 | |
| | Fuel and Service each truck 3600 miles 8 miles per gallon $0.26 per gallon plus $2.00 service charge per 1000 miles | | | 248 |
| | Pickup License $50. Insurance $35 | | 85 | |
| | Fuel and service-15,000 miles 12 miles per gallon. Gasoline $0.26 per gallon. Service charge 2.00 per 1000 miles. Tires, batteries and miscellaneous repairs $85 | | | 440 |
| | Depreciation d/ Pickup $400 trucks $400 each | | 1,200 | |
| Machinery | Harvesters Repairs fixed $500 each | | 1,000 | |
| | Repairs field 20 days at 15.00 | | | 600 |
| | Fuel 320 hours at .65 | | | 208 |
| | Lubrication 320 hours at .19 | | | 61 |
| | Depreciation d/ $787.50 | | 1,575 | |
| | Other machinery | | | |
| | Repairs other machinery for 450 acres rice c/ | | | 443 |
| | Depreciation d/ other machinery | | | |
| | Depreciation on machinery for 300 acres of rice | 1,012.00 | | |
| | Depreciation on bankout wagon added | 138.00 | | |
| | Depreciation on machinery for 450 acres of rice | 1,150.00 | 1,150 | |
| Taxes on Machinery | New cost of machinery for 300 acre rice e/ | 41,815.00 | | |
| | New cost of bankout wagon added for 450 acres rice | 1,300.00 | | |
| | | 43,115.00 | | |
| | Value of trucks already taxed | 7,800.00 | | |
| | Taxable value | 35,315.00 | | |
| | Tax formula | | | |
| | 35,315 x $\frac{70\%}{2}$ x $4.00 per $100 value x 66% = tax | | | |
| | 35,315 x .35 x .04 x .66 $326 | | 326 | |
| Improvements | Shed | | | |
| | Depreciation value of building $1800 15 years life expectancy | | 120 | |
| | Tax = 2% value of building | | 36 | |
| | Maintenance fixed yearly cost | | 50 | |

Table 6 --continued--

Table 6 - Continued.

| Item | Computation | Dollars | Cost Fixed | Cost Variable |
|---|---|---|---|---|
| | | | Dollars | |
| Interest on Operating Capital | Money obtained every two weeks to pay expenses for that period. Interest at 6% was paid for time money was used. Interest and principal is paid on November 15 for money borrowed each two week period from March 15. A total of $18,818.42 was used during this period | | | 500 |
| Taxes on Real Estate | Assessed valuation of land per acre | 33.00 | | |
| | Tax rate per $100 of assessed valuation | 4.00 | | |
| | 675 acres cropland plus 10 per cent allowed for roadways, waste land and farmstead | | | |
| | 743 acres x 33 x .04 $980.76 | | 981 | |
| Duck Control | Average cost of $1.00 per acre of rice | | | 450 |
| Custom and Rental | Seeding 720 cwt. seed at 1.00 | | | 720 |
| | Surveying 225 acres at .50 | | | 113 |
| | Checking T-7 and operator 15 hours at 7.00 | | | 105 |
| | Drying 16,931 cwt. rice at .30 | | | 5,080 |
| | Fertilizing 1,125 cwt. at .85 | | | 956 |
| | Sub total | | 7,885 | 26,980 |
| | Total Expenses g/ | | $34,865 | |

Computed for 35 cwt per acre rice yield

a/ Per hour and per acre rates used were derived from farm interview data. Inputs are summarized on Table 19.

b/ Heavy work

c/ Light work

d/ Source of depreciation of figures for equipment shown on Table 14, page 43.

e/ Source of yearly repairs costs, Appendix Table 8.

f/ New value of equipment shown on Table 14, page 43.

g/ Expenses are for a rice production of 35 cwt. per acre (dry weight).

TABLE 7

Farm Budget Summary Worksheet; Fixed and Variable Costs 600 Acres of Rice With 300 Acres of Summer Fallow

| Item | Computation | Dollars | Cost Fixed | Cost Variable |
|---|---|---|---|---|
| | | | Dollars | |
| Labor | Harvest labor 228 hours at 2.50 | | | 570 |
| | 684 hours at 1.50 | | | 1,026 |
| | Other labor 139 hours at 1.25 | | | 174 |
| | 75 hours at 1.00 | | | 75 |
| | 50 hours at 1.50 | | | 75 |
| | Annual-one man 12 months at 300.00 | | | 3,600 |
| | Monthly-Tractor driver 3 months at 350.00 | | | 1,050 |
| | Irrigator-4 months and 4 days at 300.00 | | | 1,240 |
| | State Compensation Insurance at 4% of gross wages | | | 312 |
| Materials | Seed-160 pounds per acre at 7.00 per cwt. | | | 6,720 |
| | Fertilizer-250 pounds per acre at 3.00 per cwt. | | | 4,500 |
| Irrigation | Ditches (repair and replacement) 900 acres at 1.00 | | 900 | |
| | Water 600 acres at 8.50 | | | 5,100 |
| | Repair Irrigation Boxes .4 boxes per acre Replace 1/3 per year. Cost 4.50 per box | | | 360 |
| Field Power | T7-Annual (fixed) repairs | | 100 | |
| | -Field (variable) repairs-1299 hours at .633 | | | 822 |
| | T5-Annual (fixed) repairs | | 75 | |
| | -Field (variable) repairs-345 hours at .422 | | | 146 |
| | T3-Annual (fixed) repairs | | 50 | |
| | -Field (variable) repairs-91 hours at .25 | | | 23 |
| | Fuel-T7 1139 hours at .63 b/ | 717.57 | | |
| | 160 hours at .49 c/ | 78.40 | | |
| | -T5 219 hours at .49 b/ | 107.31 | | |
| | 126 hours at .28 c/ | 35.28 | | |
| | -T3 91 hours at .78 | 70.98 | | |
| | | 1,009.54 | | 1,010 |

Table 7 --Continued--

Table 7 - Continued.

| Item | Computation | Dollars | Cost Fixed (Dollars) | Cost Variable (Dollars) |
|---|---|---|---|---|
| | Lubrication | | | |
| | Fixed lubrication costs per T7, T5, and T3 | | 41 | |
| | T7-1299 hours at .07 | 90.93 | | |
| | T5- 345 hours at .06 | 20.70 | | |
| | T3- 91 hours at .05 | 4.55 | | |
| | | 116.18 | | 116 |
| | Depreciation d/ T3 none | | | |
| | T5 | | 288 | |
| | T7 | | 600 | |
| Trucks and Pickups | Trucks-1½ ton (3) License $90, Insurance $40 on each | | 390 | |
| | Fuel and Service for 3 trucks-10,000 miles at 8 miles per gallon at $.26; Lubrication every 1,000 miles at $2.00 | | | 345 |
| | Pickup-½ ton (2) License $50, Insurance $35 on each | | 170 | |
| | Fuel and service for 2 pickups-25,000 miles at 12 miles per gallon at $.26 plus lubrication every 1,000 miles at $2.00 plus $170 for maintenance | | | 762 |
| | Depreciation-3 trucks and two pickups at $400 each | | 2,000 | |
| Machinery | Harvesters- 2 self propelled | | | |
| | Fixed repairs- $500 each | | 1,000 | |
| | Field (variable repairs) 22.8 days at 15.00 | | | 342 |
| | Fuel 182 hours at .65 | | | 118 |
| | Lubrication 182 hours at .19 | | | 35 |
| | Depreciation $787.50 on each | | 1,575 | |
| | Harvester- 1 pull type plus 1 rented | | | |
| | Annual repairs | | 300 | |
| | Field (variable) repairs 22.8 days at 15.00 | | | 342 |
| | Fuel 182 hours at .65 | | | 118 |
| | Lubrication 91 hours at .16 | | | 15 |
| | Depreciation | | 495 | |
| | Other machinery | | | |
| | Repairs on other machinery d/ | | | 519 |
| | Depreciation | | 1,548 | |
| | Taxes on Machinery | | | |
| | Total Cost $52,240 x $\frac{70\%}{2}$ x $4.00 per $100 x 2/3 | | 488 | |

Table 7 --Continued--

Table 7 - Continued.

| Item | Computation | Dollars | Cost Fixed | Cost Variable |
|---|---|---|---|---|
| | | | Dollars | |
| Improvements | Shed - value $1800 | | | |
| | Depreciation on 15 years life | | 120 | |
| | Taxes - 2% of value | | 36 | |
| | Maintenance | | 50 | |
| Interest on Operating Capital | Money borrowed every two weeks beginning March 14. Interest, 6%. Principal and interest paid Nov. 14 | | | 754 |
| Real Estate Taxes | Assessed value of land, $33.00 per acre. Tax rate - $4.00 per $100 assessed value. 900 acres cropland plus 10% for roadways, wasteland and farmstead. 990 acres x 33 x .04 = $1,306.80 | | 1,307 | |
| Duck Control | Average of 1.00 per acre for 600 acres | | | 600 |
| Custom and Rental | Harvest: | | | |
| | T7, Driver, Pull combine-11.4 days at 125.00 | | | 1,425 |
| | T7, Driver, Bankout wagon-11.4 days at 45.00 | | | 513 |
| | T5, Driver - 11.4 at 32.00 | | | 365 |
| | Checking - T7, Driver, 20 hours at 7.00 | | | 140 |
| | Surveying - 300 acres at .50 | | | 150 |
| | Seeding 160 pounds per acre at 1.00 per cwt. | | | 960 |
| | Fertilizing 250 pounds per acre at .85 per cwt. | | | 1,275 |
| | Drying 22,578 cwt. at .30 per cwt. | | | 6,773 |
| | Sub total | | 11,533 | 42,470 |
| | Total Expenses e/ | | $54,003 | |

a/ Per hour and per acre rates used were derived from farm interview data. Inputs are summarized on Table 20, page 67.

b/ Heavy work.

c/ Light work.

d/ Source of other machinery repair figures on Appendix Table 8.

e/ Expenses are for a production of 35 cwt of dry rice per acre.

Table 7 - Continued.

| Item | Computation | Dollars | Cost Fixed | Cost Variable |
|---|---|---|---|---|
| Improvements | Shed - value $1500<br>Depreciation on 15 years life<br>Taxes - 2% of value<br>Maintenance | | 120<br>30<br>50 | |
| Interest on Operating Capital | Money borrowed every two weeks beginning March 12. Interest, 6%. Principal and interest paid Nov. 12 | | | 751 |
| Cost Rates Taxes | Assessed value of land, $23.00 per acre.<br>Tax rate - $4.00 per $100 assessed value.<br>300 acres cropland plus 10% for roadways, waterland and farmstead. 990 acres x 23 x .04 = $1,306.80 | | 1,307 | |
| Duck Control | Average of 1.00 per acre for 600 acres | | | 600 |
| Combine and Varied | Harvest:<br>T7, Driver, full combine-12.4 days at 125.00<br>T7, Driver, Bobcat wagon-12.4 days at 45.00<br>T5, Driver - 12.4 at 32.00<br>Checking - T7, Driver, 20 hours at 7.00<br>Surveying - 300 acres at .50<br>Seeding 160 pounds per acre at 1.00 per cwt.<br>Fertilizing 250 pounds per acre at .85 per cwt.<br>Drying 22,528 cwt. at .30 per cwt. | | 1,625<br>515<br>365<br>140<br>150<br>400<br>1,278<br>6,773 | |
| | Sub total<br>Total Expense a/ | | 12,533<br>$21,003 | 1,470 |

a/ Per hour and per acre rates used were derived from farm interview data. Inputs are summarized on Table 20, page 67.

b/ Heavy work.

c/ Light work.

d/ Source of other machinery repair figures on Appendix Table 8.

e/ Expenses are for a production of 35 cwt of dry rice per acre.

TABLE 8

Annual Machinery Repair Costs, Excluding Tractors, Trucks, and Harvesters; 150, 300, 450 and 600 Acre Rice Farms

| Machinery | 300 acres using a T-7 tractor | | | 150 acres using a T-5 tractor | | 300 acres using a T-5 tractor | | 450 acres using a T-7 tractor | | 600 acres of rice using a T-7 and a T-5 tractor | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Annual repairs | Acres use | Per acre | Acres use | Annual repairs | Acres use | Annual repairs | Acres use | Annual repairs | Acres use | Annual repairs |
| | Dollars | | Dollars | | Dollars | | Dollars | | Dollars | | Dollars |
| Plow | 50.00 | 450 | .111 | 225 | 25.00 | 450 | 50.00 | 675 | 74.99 | 900 | 99.99 |
| Disk | 40.00 | 600 | .066 | 300 | 19.98 | 600 | 39.96 | 900 | 59.94 | 1200 | 79.92 |
| Harrow | 13.32 | 300 | .044 | 150 | 6.66 | 300 | 13.32 | 450 | 19.98 | 600 | 26.64 |
| Float | -- | -- | -- | -- | | | | -- | -- | -- | -- |
| Checker | 25.00 | 150 | .166 | 75 | a/ | 150 | a/ | 225 | 37.49 | 300 | 49.98 |
| Chisel | 50.00 | 150 | .333 | 75 | 25.00 a/ | 150 | 50.00 a/ | 225 | 74.99 | 300 | 99.99 |
| Ditcher | -- | -- | -- | | | -- | | -- | -- | -- | -- |
| Landplane | 25.00 | 150 | .166 | | a/ | 150 | 24.99 | 225 | 37.49 | 300 | 49.98 |
| Bankout Wagon | 65.00 | 300 | .216 | 150 | 32.49 | 300 | 64.98 | 450 | 97.47 | 300 b/ | 64.98 |
| | 268.24 | | 1.11 | | 109.13 | | 243.25 | | 402.35 | | 471.48 |
| plus 10% c/ | 26.82 | | | | 10.91 | | 24.33 | | 40.24 | | 47.15 |
| Total repairs | 295.06 | | | | 120.04 | | 267.58 | | 442.59 | | 518.63 |

a/ Equipment is custom hired for these operations. Pay for repairs on hired chisel but not on hired landplane.

b/ Does not pay for repairs on hired bankout wagon.

c/ Ten percent extra repair cost is included to cover repairs to small items too numerous to mention.

TABLE 8

Market Equipment Repair Costs, Excluding Tractors, Trucks, and Harvesters, 150, 300, 150 and 600 Acre Farm Units

| Equipment | 150 acre farm unit | | | 300 acre farm unit | | | 150 acre farm unit | | | 600 acre farm unit | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-1 & 1-2 tractor | | | 2-1 & 2-2 tractor | | | 1-1 & 1-2 tractor | | | 1-1 & 1-2 plus 2-1 & 2-2 tractor | | |
| | Market Repair Costs | New Values | Old Value | New Values | Market Repair Costs | New Values | Market Repair Costs | New Values | Market Repair Costs | New Values | Market Repair Costs | New Values |
| | Dollars | | Dollars | | Dollars | | Dollars | | Dollars | | Dollars | |
| Plow | 66.66 | 006 | 111. | 552 | 00.52 | 051 | 00.05 | 529 | 66.11 | 006 | 66.66 | 006 |
| Disk | 26.61 | 0021 | 990. | 006 | 86.61 | 009 | 96.86 | 005 | 16.65 | 0021 | 26.61 | 0021 |
| Mulcher | 12.92 | 009 | 1110. | 051 | 22.9 | 006 | 26.61 | 051 | 86.61 | 009 | 12.92 | 009 |
| Rake | — | — | — | — | — | — | — | — | — | — | — | — |
| Cultivator | 66.66 | 006 | 990. | 051 | 52.00 \/a | 051 | 00.05 \/a | 552 | 66.11 | 006 | 66.66 | 006 |
| Spreader | 86.41 | 006 | 990. | 51 | \/a | 051 | \/a | 552 | 61.41 | 006 | 86.41 | 006 |
| Chisel | 00.05 | 051 | 666. | 51 | 52.00 \/a | 051 | 00.05 \/a | 552 | 86.11 | 006 | 66.66 | 006 |
| Planter | — | — | — | — | — | — | — | — | — | — | — | — |
| Mower | 00.52 | 051 | 990. | 51 | \/a | 051 | \/a | 552 | 61.41 | 006 | 86.41 | 006 |
| Combine | 00.05 | 051 | 111. | 552 | 00.52 | 051 | 00.05 | 519 | 66.11 | 006 | 66.66 | 006 |
| Baler | 00.05 | 051 | 111. | 552 | 00.52 | 051 | 00.05 | 519 | 66.11 | 006 | 66.66 | 006 |
| Other Equipment | 00.52 | 051 | 990. | 51 | 52.00 \/a | 051 | 00.05 \/a | 552 | 61.41 | 006 | 86.41 | 006 |
| Farmhand Mower | 00.52 | 051 | 990. | 051 | 52.00 \/a | 051 | 00.05 \/a | 552 | 61.41 | 006 | 86.41 | 006 |
| Farmhand Rake | 00.52 | 051 | 990. | 051 | 52.00 \/a | 051 | 00.05 \/a | 552 | 61.41 | 006 | 86.41 | 006 |
| Farmhand Baler | 00.52 | 051 | 990. | 051 | 52.00 \/a | 051 | 00.05 \/a | 552 | 61.41 | 006 | 86.41 | 006 |

\/a Dose not help for relative to direct planting method.

\/b Equipment is common based for fuses dis-assembly. Key for relative to drill depth and not on drill requirement.

\/c For forecast extra repair cost is included to cover the fix to drill frame, to numerous to analysis.